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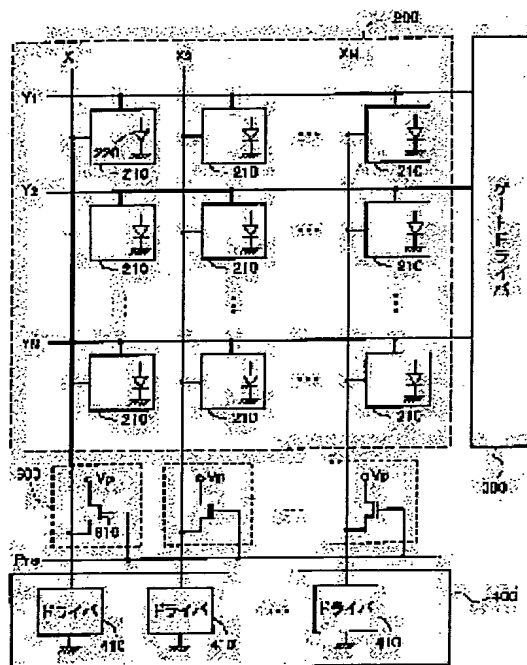
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(54) DRIVING OF DATA LINE USED TO CONTROL UNIT CIRCUIT

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce driving time of a data line connected to a unit circuit.

SOLUTION: A display matrix section 200 has pixel circuits 210 which are arranged in a matrix manner, a plurality of gate lines Y1 and Y2, etc., extended along a row direction and a plurality of data lines X1, X2, etc., extended in a column direction. Scanning lines are connected to a gate driver 300 and data lines are connected to a data line driver 400. A precharge circuit 600 and an added current circuit are provided for each data line as a means to accelerate charging or discharging of the data line. For each data line, the acceleration of charging or discharging is conducted by precharges and added current prior to the completion of the setting of light emitting gradation in the circuit 210.



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CLAIMS

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## [Claim(s)]

[Claim 1] The unit circuit matrix by which two or more unit circuits which are the electro-optic devices driven by the active-matrix driving method, and include the circuit for adjusting the gradation of luminescence of a light emitting device and said light emitting device, respectively were arranged in the shape of a matrix, Two or more scanning lines connected to the unit circuit group arranged along with the line writing direction of said unit circuit matrix, respectively, Two or more data lines connected to the unit circuit group arranged along the direction of a train of said unit circuit matrix, respectively, The scanning-line drive circuit for connecting with said two or more scanning lines, and choosing one line of said unit circuit matrix, The data signal generation circuit which the data signal according to the gradation of luminescence of said light emitting device is generated, and can be outputted on [ of said two or more data lines ] at least one data line, An electro-optic device equipped with the charge-and-discharge acceleration section which can accelerate charge or discharge of said data line in case said data signal is supplied to at least one unit circuit which exists in the line chosen by said scanning-line drive circuit through said data line.

[Claim 2] It is the electro-optic device with which it is an electro-optic device according to claim 1, and accommodation of said luminescence gradation by said unit circuit is performed according to the current value of said data signal.

[Claim 3] It is an electro-optic device according to claim 1 or 2. Said light emitting device It is the component of the current drive mold from which the gradation of luminescence changes according to the flowing current value. Said unit circuit By connecting with the control electrode of the drive transistor prepared in the path of a current of flowing to said light emitting device, and said drive transistor, and holding the amount of charges according to the operating state of said drive transistor The electro-optic device to which it has a maintenance capacitor for setting up the current value which flows to said light emitting device, and the amount of stored charge of said maintenance capacitor is adjusted by said data signal.

[Claim 4] It is an electro-optic device according to claim 3. Said unit circuit Furthermore, the 1st switching transistor used in case it connects with said data line and said maintenance capacitor and said data signal adjusts the amount of stored charge of said maintenance capacitor. It has the 2nd switching transistor connected at the drive transistor, and said said light emitting device and serial. Each scanning line The said 1st, 1st [ which were connected to each of the 2nd switching transistor ], and 2nd sub scanning line is included. Said scanning-line drive circuit (i) In the 1st actuation which sets said 1st switching transistor as an ON state, and adjusts the amount of stored charge of said maintenance capacitor in the 1st predetermined period, and the 2nd period after the 1st period of (ii) above The electro-optic device which sets said 2nd switching transistor as an ON state while setting said 1st switching transistor as an OFF state, and performs 2nd actuation made to emit light to said light emitting device.

[Claim 5] It is an electro-optic device including the precharge circuit where are an electro-optic device according to claim 1 to 4, and it is possible for said charge-and-discharge acceleration section to precharge said two or more data lines.

[Claim 6] Said precharge circuit is an electro-optic device which are periods other than said 2nd period, and performs said precharge in the specific precharge period before said 1st period is completed including the precharge circuit where it is possible to be an electro-optic device according to claim 4, and for said charge-and-discharge acceleration section to precharge said two or more data lines.

[Claim 7] Said precharge period is an electro-optic device set up before being an electro-optic device according to claim 6 and starting said 1st period.

[Claim 8] It is the electro-optic device set as the period when it is an electro-optic device according to claim 6 at, and said precharge period contains a part of early stages of said 1st period.

[Claim 9] When it is an electro-optic device according to claim 5 to 8 and said precharge circuit precharges said data line, it is the electro-optic device which makes said data line the electrical potential difference equivalent to a low tonal range below the median of luminescence gradation.

[Claim 10] When it is an electro-optic device according to claim 9 and said precharge circuit precharges said data line, it is the electro-optic device which makes said data line the electrical potential difference equivalent to the gradation near the lowest luminescence gradation that is not zero.

[Claim 11] It is the electro-optic device which it is an electro-optic device according to claim 5 to 10, and each unit circuit is prepared for two or more color components of every, respectively, and can be charged or discharged by

said precharge circuit in said data line with different potential for every color component.

[Claim 12] Said charge-and-discharge acceleration section is an electro-optic device including the addition current circuit which adds the current value for accelerating charge or discharge of said data line to the current value of the data signal are an electro-optic device according to claim 1 to 4, and corresponding to the gradation of luminescence of each of said light emitting device.

[Claim 13] Addition of said current value is an electro-optic device performed in early stages of the period when the data signal are an electro-optic device according to claim 12, and corresponding to the gradation of luminescence of each of said light emitting device is generated.

[Claim 14] It is an electro-optic device containing the transistor which is an electro-optic device according to claim 12 or 13 and by which said addition current circuit was connected to said data signal generation circuit and juxtaposition to each data line.

[Claim 15] The unit circuit matrix by which two or more unit circuits which include the circuit for adjusting the gradation of luminescence of a light emitting device and said light emitting device, respectively were arranged in the shape of a matrix, Two or more data lines for supplying the data signal according to the gradation of luminescence of each light emitting device to each unit circuit, The drive approach of the electro-optic device which is the drive approach of the electro-optic device of a \*\*\*\*\* active-matrix drive mold, and is characterized by accelerating charge or discharge of said data line in case said data signal is supplied to at least one unit circuit through said data line.

[Claim 16] Accommodation of the luminescence gradation of said light emitting device are an approach according to claim 15 and according to said unit circuit is an approach performed according to said data signal supplied as a current.

[Claim 17] Acceleration of said charge or discharge is an approach performed by precharging [ in / are an approach according to claim 15 or 16, and / a predetermined precharge period ] said data line.

[Claim 18] Are an approach according to claim 17 and it sets at the 1st (i) predetermined period. In the process in which said unit circuit by said data signal is set up, and the 2nd period after the 1st period of (ii) above It is the approach which it has the process in which said light emitting device emits light according to the established state of said unit circuit, and said precharge periods are periods other than said 2nd period, and is set up before said 1st period is completed.

[Claim 19] Said precharge period is an approach set up before being an approach according to claim 18 and starting said 1st period.

[Claim 20] It is the approach set as the period when it is an approach according to claim 18 at, and said precharge period contains a part of early stages of said 1st period.

[Claim 21] It is the approach performed so that it may be an approach according to claim 17 to 20 and said precharge may charge or discharge said data line to the electrical-potential-difference value equivalent to a low tonal range below the median of luminescence gradation.

[Claim 22] It is the approach performed so that it may be an approach according to claim 21 and said precharge may charge or discharge said data line to the electrical-potential-difference value equivalent to the gradation near the lowest luminescence gradation that is not zero.

[Claim 23] It is the approach performed by being an approach according to claim 17 to 22, and preparing each unit circuit for two or more color components of every, respectively so that said precharge may charge or discharge said data line with different potential for every color component.

[Claim 24] Acceleration of said charge or discharge is an approach performed by adding the current value for acceleration of said charge or discharge to the current value of the data signal are an approach according to claim 15 or 16, and corresponding to the gradation of luminescence of each of said light emitting device.

[Claim 25] Addition of said current value is an approach performed in early stages of the period when the data signal are an approach according to claim 24 and corresponding to the gradation of luminescence of each of said light emitting device is generated.

[Claim 26] An electronic instrument equipped with two or more current driver elements by which actuation is controlled according to the current value of the flowing current, the data line for supplying the data signal which specifies the operating state of said current driver element to each current driver element, the data signal generation circuit for outputting said data signal to said data line, and the charge-and-discharge acceleration section for accelerating charge or discharge of said data line, in case said data signal is supplied to said current driver element through said data line.

[Claim 27] It is an electronic instrument including the precharge circuit where are an electronic instrument according to claim 26, and it is possible for said charge-and-discharge acceleration section to precharge said two or more data lines.

[Claim 28] It is an electronic instrument including the addition current circuit which adds a current value to be an electronic instrument according to claim 26, and for said charge-and-discharge acceleration section accelerate charge or discharge of said data line to the current value of said data signal suitable for the operating state of said current driver element.

[Claim 29] It is an electro-optic device containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the electro-optics component, and the data line which supplies said current to said unit circuit. Electro-optic device characterized by having an acceleration means to accelerate change of said current accompanying change of said input signal.

[Claim 30] Said acceleration means is an electro-optic device according to claim 29 characterized by being the

precharge circuit which sets the potential of said data line as predetermined potential.

[Claim 31] Said acceleration means is an electro-optic device according to claim 29 characterized by being an addition current circuit used as some current paths of a current of flowing to said data line.

[Claim 32] An electro-optic device given in claim 29 thru/or any of 31 they are. [ which is characterized by having the decision circuit which judges the necessity of use of said acceleration means based on the variation of said current accompanying change of said input signal ]

[Claim 33] The drive approach of the electro-optic device characterized by to perform actuation of being the drive approach of the electro-optic device containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the electro-optics component, and the data line which supplies said current to said unit circuit, and changing the current value of said current from the 1st current value to the 2nd current value with change of said input signal, through two or more periods when the time-amount rate of change of a current value differs.

[Claim 34] Actuation of making it changing from said 1st current value to the 2nd current value is the drive approach of the electro-optic device according to claim 33 characterized by being carried out via the 3rd current value set up by the precharge circuit which sets said data line as a predetermined electrical potential difference.

[Claim 35] Actuation of making it changing from said 1st current value to the 2nd current value is the drive approach of the electro-optic device according to claim 33 characterized by being carried out via the 3rd current value set up by the addition current circuit used as some current paths of a current of flowing to said data line.

[Claim 36] Said 3rd current value is the drive approach of the electro-optic device according to claim 35 characterized by being set up based on the current value which flows said the 2nd current value and said addition current circuit.

[Claim 37] Said 3rd current value is the drive approach of the electro-optic device according to claim 35 characterized by being set up based on the current value which flows said the 1st current value and said addition current circuit.

[Claim 38] Said 2nd current value is the drive approach of an electro-optic device given in claim 33 thru/or any of 37 they are. [ which is characterized by being smaller than said 1st current value ]

[Claim 39] Said 3rd current value is the drive approach of the electro-optic device according to claim 37 characterized by being a current value between said 1st current value and said 2nd current value.

[Claim 40] The absolute value of the time amount rate of change of the current value from said 1st current value to said 3rd current value is the drive approach of the electro-optic device according to claim 39 characterized by being larger than the absolute value of the time amount rate of change of the current value from said 3rd current value to said 2nd current value.

[Claim 41] The absolute value of the difference of said 1st current value and said 3rd current value is the drive approach of the electro-optic device according to claim 40 characterized by being larger than the absolute value of the difference of said 3rd current value and said 2nd current value.

[Claim 42] Said the 1st current value and said 2nd current value are the drive approach of an electro-optic device given in claim 33 thru/or any of 41 they are. [ which is characterized by being a current value corresponding to said input signal ]

[Claim 43] Based on the difference of said 1st current value and said 2nd current value, actuation of changing said 1st current value to the 2nd current value When it judges and is judged with there being need by the judgment concerned, whether it is necessary to carry out through two or more periods when the time amount rate of change of said current value differs The drive approach of an electro-optic device given in claim 33 thru/or any of 42 they are. [ which is characterized by changing said 1st current value to said 2nd current value through said two or more periods ]

[Claim 44] The electro-optic device characterized by driving by the drive approach of an electro-optic device given in any [ said claim 33 thru/or ] of 43 they are.

[Claim 45] The electro-optic device which is an electro-optic device containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the electro-optics component, and the data line which supplies said current to said unit circuit, and is characterized by having the resetting means which resets the charge of said data line in case said current is changed corresponding to change of said input signal.

[Claim 46] It is the electro-optic device according to claim 45 which is equipped with an electrical-potential-difference maintenance means to hold the electrical potential difference according to said current, and is characterized by said resetting means resetting the charge of said data line and said electrical-potential-difference maintenance means.

[Claim 47] Said resetting means is an electro-optic device according to claim 45 or 46 characterized by performing said reset before changing said current.

[Claim 48] The electronic instrument characterized by having an acceleration means to be an electronic instrument containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the current driver element, and the data line which supplies said current to said unit circuit, and to accelerate change of said current accompanying change of said input signal.

[Claim 49] Said acceleration means is an electronic instrument according to claim 48 characterized by being the precharge circuit which sets the potential of said data line as predetermined potential.

[Claim 50] Said acceleration means is an electronic instrument according to claim 48 characterized by being an addition current circuit used as some current paths of a current of flowing to said data line.

[Claim 51] An electronic instrument given in claim 48 thru/or any of 50 they are. [ which is characterized by having the decision circuit which judges the necessity of use of said acceleration means based on the variation of said current accompanying change of said input signal ]

[Claim 52] Electronic equipment characterized by using an electro-optic device given in any [ claim 29 thru/or 32 and claim 44 thru/or ] of 47 they are as a display.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the drive technique of the data line used for control of unit circuits, such as a pixel circuit of an indicating equipment.

[0002]

[Description of the Prior Art] In recent years, the electro-optic device using an organic EL device (Organic ElectroLuminescent element) is developed. Since an organic EL device is a spontaneous light corpuscle child and the back light is unnecessary, it is expected that a low power, a high angle of visibility, and the display of a high contrast ratio can be attained. In addition, in this specification, the "electro-optic device" means the equipment which changes an electrical signal into light. The most ordinary gestalt of an electro-optic device is equipment which changes the electrical signal showing an image into the light showing an image, and is suitable especially as a display.

[0003] Drawing 1 is the block diagram showing the general configuration of the indicating equipment which used the organic EL device. This indicating equipment has the display matrix section 120, the gate driver 130, and the data-line driver 140. The display matrix section 120 has two or more pixel circuits 110 arranged in the shape of a matrix, and the organic EL device 114 is formed in each pixel circuit 110, respectively. Two or more data lines X1 extended along the direction of a train, X2 —, and two or more gate lines Y1 and Y2 — which are extended along with a line writing direction are connected to the matrix of the pixel circuit 110, respectively.

[0004]

[Problem(s) to be Solved by the Invention] In constituting a large-sized display panel from a configuration like drawing 1, the electrostatic capacity Cd of each data line becomes quite large. If the electrostatic capacity Cd of the data line becomes large, the drive of the data line will take great time amount. Therefore, there was a problem that a sufficiently high-speed drive could not be carried out to constituting a large-sized display panel conventionally using an organic EL device.

[0005] In addition, the above-mentioned problem was a problem not only common to the display which used the organic EL device but the displays and electro-optic devices using a current drive mold light emitting device other than an organic EL device. Moreover, it was a problem not only common to a light emitting device but the electronic instrument using the current driver element generally driven with a current.

[0006] This invention is made in order to solve the conventional technical problem mentioned above, and it aims at offering the technique which can shorten the drive time amount of the data line connected to the unit circuit.

[0007]

[The means for solving a technical problem, and its operation and effectiveness] In order to attain the above-mentioned purpose, the 1st electro-optic device by this invention The unit circuit matrix by which two or more unit circuits which are the electro-optic devices driven by the active-matrix driving method, and include the circuit for adjusting the gradation of luminescence of a light emitting device and said light emitting device, respectively were arranged in the shape of a matrix, Two or more scanning lines connected to the unit circuit group arranged along with the line writing direction of said unit circuit matrix, respectively, Two or more data lines connected to the unit circuit group arranged along the direction of a train of said unit circuit matrix, respectively, The scanning-line drive circuit for connecting with said two or more scanning lines, and choosing one line of said unit circuit matrix, The data signal generation circuit which the data signal according to the gradation of luminescence of said light emitting device is generated, and can be outputted on [ of said two or more data lines ] at least one data line, In case said data signal is supplied to at least one unit circuit which exists in the line chosen by said scanning-line drive circuit through said data line, it has the charge-and-discharge acceleration section which can accelerate charge or discharge of said data line.

[0008] In this electro-optic device, since the charge-and-discharge acceleration section accelerates charge or discharge of the data line, the time amount which charge or discharge takes compared with the case where charge or discharge of the data line is performed, only with a data signal can be shortened. Therefore, it is possible to shorten the drive time amount of the data line connected to the unit circuit.

[0009] In addition, as for accommodation of said luminescence gradation by said unit circuit, it is desirable that it is what is performed according to the current value of said data signal. In this case, when the current value of a data signal is small, charge or discharge of the data line may take great time amount. Therefore, when especially the current value of a data signal is small, the compaction effectiveness of the drive time amount of the data line by the

charge-and-discharge acceleration section is remarkable.

[0010] Moreover, though said light emitting device is a component of the current drive mold from which the gradation of luminescence changes according to the flowing current value, it is good. Moreover, it connects with the control electrode of the drive transistor prepared in the path of a current of flowing to said light emitting device, and said drive transistor, and said unit circuit may have the maintenance capacitor for setting up the current value which flows to said light emitting device by holding the amount of charges according to the operating state of said drive transistor. At this time, the amount of stored charge of said maintenance capacitor may be made to be adjusted by said data signal. It is necessary to set the amount of stored charge of a maintenance capacitor as the suitable value according to luminescence gradation with this configuration. If charge or discharge of the data line is accelerated by the charge-and-discharge acceleration section at this time, the suitable amount of stored charge can be attained comparatively in a short time, and it is possible to carry out time amount compaction of the drive of the data line.

[0011] Further, it connects with said data line and said maintenance capacitor, and said unit circuit may have the 1st switching transistor used in case said data signal adjusts the amount of stored charge of said maintenance capacitor, and the 2nd switching transistor connected at the drive transistor, and said said light emitting device and serial. Moreover, each scanning line may contain the said 1st, 1st [ which were connected to each of the 2nd switching transistor ], and 2nd sub scanning line. At this time, said scanning-line drive circuit is set at the 1st (i) predetermined period. In the 1st actuation which sets said 1st switching transistor as an ON state, and adjusts the amount of stored charge of said maintenance capacitor, and the 2nd period after the 1st period of (ii) above It is good also as what performs 2nd actuation which sets said 2nd switching transistor as an ON state while setting said 1st switching transistor as an OFF state, and is made to emit light to said light emitting device.

[0012] Said charge-and-discharge acceleration section is good also as a thing including the precharge circuit which can precharge said two or more data lines. According to this configuration, charge or discharge of the data line can be promoted easily.

[0013] In addition, said precharge circuit is good also as what is periods other than said 2nd period, and performs said precharge in the specific precharge period before said 1st period is completed. Since according to this configuration precharge is performed before are recording of the charge to a maintenance capacitor is completed, precharge can prevent that become a cause and the amount of stored charge of a maintenance capacitor shifts from a desired value.

[0014] As for said precharge period, it is desirable to be set up before starting said 1st period. It is possible to suppress smaller the effect which precharge has on the amount of stored charge of a maintenance capacitor with this configuration.

[0015] Or said precharge period may be made to be set as the period containing a part of early stages of said 1st period. According to this configuration, when the electrostatic capacity of a maintenance capacitor cannot be disregarded compared with the electrostatic capacity of the data line, the time amount which are recording of the charge to a maintenance capacitor takes can be shortened.

[0016] As for said precharge circuit, it is desirable by precharging said data line to make said data line into the electrical potential difference equivalent to a low tonal range below the median of luminescence gradation. According to this configuration, luminescence gradation is low, and also when the charge or discharge of the data line by the data signal takes time amount, that time amount can be shortened.

[0017] In addition, as for said precharge circuit, it is desirable by precharging said data line to make said data line into the electrical potential difference equivalent to the gradation near the lowest luminescence gradation that is not zero. According to this configuration, the compaction effectiveness of charge/charging time value of the data line is the most remarkable.

[0018] When each unit circuit is prepared for two or more color components of every, respectively, as for said precharge circuit, it is desirable that it is possible to charge or discharge said data line with different potential for every color component. Since the data line can be charged or discharged to the potential suitable for each color component, respectively according to this configuration, it is possible to shorten the drive time amount of the data line more.

[0019] Said charge-and-discharge acceleration section is good also as a thing including the addition current circuit which adds the current value for accelerating charge or discharge of said data line to the current value of the data signal according to the gradation of luminescence of each of said light emitting device. Also by this configuration, charge or discharge of the data line can be promoted easily.

[0020] Addition of said current value is good also as what is performed in early stages of the period when the data signal according to the gradation of luminescence of each of said light emitting device is generated. If it carries out like this, the effect of the luminescence gradation on the light emitting device by addition of a current value can be suppressed small.

[0021] Said addition current circuit is good also as a thing containing the transistor connected to said data signal generation circuit and juxtaposition to each data line. According to this configuration, an addition current can be generated easily.

[0022] The 1st drive approach of the electro-optic device by this invention The unit circuit matrix by which two or more unit circuits which include the circuit for adjusting the gradation of luminescence of a light emitting device and said light emitting device, respectively were arranged in the shape of a matrix, Two or more data lines for supplying the data signal according to the gradation of luminescence of each light emitting device to each unit circuit, It is the

drive approach of the electro-optic device of a \*\*\*\*\* active-matrix drive mold, and in case said data signal is supplied to at least one unit circuit through said data line, it is characterized by accelerating charge or discharge of said data line.

[0023] Moreover, the electronic instrument by this invention is equipped with the data-signal generation circuit for outputting said data signal on two or more current driver elements by which actuation is controlled according to the flowing current value, the data line for supplying the data signal which specifies the operating state of said current driver element to each current driver element, and said data line, and the charge-and-discharge acceleration section for accelerating charge or discharge of said data line, in case said data signal is supplied through said data line at said current driver element.

[0024] The 2nd electro-optic device by this invention is an electro-optic device containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the electro-optics component, and the data line which supplies said current to said unit circuit, and is characterized by having an acceleration means to accelerate change of said current accompanying change of said input signal.

[0025] Since according to this electro-optic device an acceleration means performs acceleration actuation of accelerating change of the current accompanying change of an input signal in case a current is changed with change of an input signal, according to an input signal, a current value can be changed promptly. Therefore, it is possible to shorten the drive time amount of the data line connected to the unit circuit.

[0026] In addition, said acceleration means is good also as what is the precharge circuit which sets the potential of said data line as predetermined potential.

[0027] Or it is also as what is an addition current circuit used as some current paths of a current of flowing to said data line, and said acceleration means is \*\*.

[0028] The 2nd electro-optic device may be equipped with the decision circuit which judges the necessity of use of said acceleration means based on the variation of said current accompanying change of said input signal. According to this configuration, only when required, accelerating is possible, and the drive time amount of the data line can be shortened further.

[0029] The 2nd drive approach of the electro-optic device by this invention The current generation circuit which generates a current corresponding to an input signal, and the unit circuit equipped with the electro-optics component, It is the drive approach of the electro-optic device containing the data line which supplies said current to said unit circuit, and is characterized by performing actuation of changing the current value of said current from the 1st current value to the 2nd current value with change of said input signal, through two or more periods when the time amount rate of change of a current value differs.

[0030] Since according to this configuration it was made to perform actuation of making it changing from the 1st current value to the 2nd current value through two or more periods when time amount rate of change differs when changing a current with change of an input signal, compaction of the duration taken to change from the 1st current value to the 2nd current value can be aimed at. Therefore, it is possible to shorten the drive time amount of the data line connected to the unit circuit.

[0031] The 3rd electro-optic device by this invention is an electro-optic device containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the electro-optics component, and the data line which supplies said current to said unit circuit, and in case said current is changed corresponding to change of said input signal, it is characterized by having the resetting means which resets the charge of said data line.

[0032] Since according to this electro-optic device the charge of the data line was reset by the resetting means when changing a current corresponding to change of an input signal, the current value of the data line can be changed more promptly. Therefore, it is possible to shorten the drive time amount of the data line connected to the unit circuit.

[0033] Said unit circuit is equipped with an electrical-potential-difference maintenance means to hold the electrical potential difference according to said current. Said resetting means resets the charge of said data line and said electrical-potential-difference maintenance means. Since both the charges of the data line and an electrical-potential-difference maintenance means were reset, not only the data line but the maintenance electrical potential difference of an electrical-potential-difference maintenance means can be made promptly in agreement according to this configuration with the maintenance electrical potential difference according to the current value after change.

[0034] The 2nd electronic instrument by this invention is an electronic instrument containing the current generation circuit which generates a current corresponding to an input signal, the unit circuit equipped with the current driver element, and the data line which supplies said current to said unit circuit, and is characterized by having an acceleration means to accelerate change of said current accompanying change of said input signal.

[0035] In addition, this invention can be realized with various gestalten, for example, can be realized with gestalten, such as a computer program for realizing the drive approach of an electro-optic device, a display, the electronic instruments equipped with the electro-optic device and display, and those equipments, and the function of the approach, a record medium which recorded the computer program, and a data signal embodied in the subcarrier including the computer program.

[0036]

[Embodiment of the Invention] Next, the gestalt of operation of this invention is explained in order of the following based on an example.

A. 1st example (1 of addition \*\*\*\*\*): — B. 2nd example (2 of addition \*\*\*\*\*): — C. 3rd example (3 of addition

\*\*\*\*\*): — modification: using D. addition current — E. 4th example (precharge): — example [ to the modification:H. electronic equipment about the arrangement of a modification:G. precharge circuit about F. precharge timing ] of application: — modification: [0037] of I. and others A. The 1st example (1 of addition \*\*\*\*\*): drawing 2 is the block diagram showing the outline configuration of the indicating equipment as the 1st example of this invention. This display has a controller 100, the display matrix section 200 (it is also called a "pixel field"), the gate driver 300, and the data-line driver 400. A controller 100 generates the gate line driving signal and data-line driving signal for making it display on the display matrix section 200, and supplies them to a gate driver 300 and the data-line driver 400, respectively.

[0038] Drawing 3 shows the internal configuration of the display matrix section 200 and the data-line driver 400. The display matrix section 200 has two or more pixel circuits 210 arranged in the shape of a matrix, and each pixel circuit 210 has the organic EL device 220, respectively. Two or more data lines  $X_m$  ( $m=1-M$ ) extended along the direction of a train and two or more gate lines  $Y_n$  ( $n=1-N$ ) extended along with a line writing direction are connected to the matrix of the pixel circuit 210, respectively. In addition, the data line is also called a "source line" and a gate line is also called the "scanning line." Moreover, on these specifications, the pixel circuit 210 is also called a "unit circuit" or a "pixel." The transistor in the pixel circuit 210 usually consists of TFT(s).

[0039] A gate driver 300 is driven alternatively [ one ] in two or more gate lines  $Y_n$ , and chooses the pixel circuit group for one line. The data-line driver 400 has two or more single line drivers 410 for driving each data line  $X_m$ , respectively. These single line drivers 410 supply a data signal to the pixel circuit 210 through each data line  $X_m$ . If the internal state (it mentions later) of the pixel circuit 210 is set up according to this data signal, the current value which flows to an organic EL device 220 according to this will be controlled, consequently the gradation of luminescence of an organic EL device 220 will be controlled.

[0040] A controller 100 ( drawing 2 ) is changed into the matrix data showing the gradation of luminescence of each organic EL device 220 by the indicative data (image data) showing the display condition of the pixel field 200. Matrix data include the gate line driving signal for making sequential selection of the pixel circuit group for one line, and the data-line driving signal which shows the level of the data-line signal which supplies the organic EL device 220 of the selected pixel circuit group. A gate line driving signal and a data-line driving signal are supplied to a gate driver 300 and the data-line driver 400, respectively. A controller 100 performs timing control of the drive timing of a gate line and the data line again.

[0041] Drawing 4 is the circuit diagram showing the internal configuration of the pixel circuit 210. This pixel circuit 210 is a circuit arranged at the intersection of the  $m$ -th data line and the  $n$ -th gate line  $Y_n$ . In addition, the gate line  $Y_n$  contains two subgate lines  $V1$  and  $V2$ .

[0042] The pixel circuit 210 is a current program circuit which adjusts the gradation of an organic EL device 220 according to the current value which flows to the data line  $X_m$ . Specifically, this pixel circuit 210 has four transistors 211-214 and maintenance capacitors 230 (it is also called a "maintenance capacitor" or a "storage capacitor") other than an organic EL device 220. The maintenance capacitor 230 is for holding the charge according to the data signal supplied through the data line  $X_m$ , and adjusting the gradation of luminescence of an organic EL device 220 by this. That is, the maintenance capacitor 230 is equivalent to an electrical-potential-difference maintenance means to hold the electrical potential difference according to the current which flows to the data line  $X_m$ . The 1st thru/or the 3rd transistor 211-213 are the  $n$  channel molds FET, and the 4th transistor 214 is the  $p$  channel mold FET. Since an organic EL device 220 is a light emitting device of the same current impregnation mold (current drive mold) as a photodiode, it is drawn with the notation of diode here.

[0043] The source of the 1st transistor 211 is looked like [ the drain of the 2nd transistor 212, the drain of the 3rd transistor 213, and the drain of the 4th transistor 214 ], and is connected with them, respectively. The drain of the 1st transistor 211 is connected to the gate of the 4th transistor 214. The maintenance capacitor 230 is connected between the source of the 4th transistor 214, and the gate. Moreover, the source of the 4th transistor 214 is connected also to the power-source potential  $V_{dd}$ .

[0044] The source of the 2nd transistor 212 is connected to the single line driver 410 ( drawing 3 ) through the data line  $X_m$ . The organic EL device 220 is connected between the source of the 3rd transistor 213, and touch-down potential.

[0045] The gate of the 1st and the 2nd transistor 211,212 is connected to the 1st subgate line  $V1$  in common. Moreover, the gate of the 3rd transistor 213 is connected to the 2nd subgate line  $V2$ .

[0046] The 1st and the 2nd transistor 211,212 are switching transistors used in case a charge is accumulated in the maintenance capacitor 230. The 3rd transistor 213 is a switching transistor maintained at an ON state in the luminescence period of an organic EL device 220. Moreover, the 4th transistor 214 is a drive transistor for controlling the current value which flows to an organic EL device 220. The current value of the 4th transistor 214 is controlled by the amount of charges (the amount of stored charge) held at the maintenance capacitor 230.

[0047] Drawing 5 is a timing chart which shows the usual actuation of the pixel circuit 210. Here, the electrical-potential-difference value ("the 1st gate signal  $V1$ " is called hereafter) of the 1st subgate line  $V1$ , the electrical-potential-difference value ("the 2nd gate signal  $V2$ " is called hereafter) of the 2nd subgate line  $V2$ , and the current value  $I_{out}$  of the data line  $X_m$  ("data signal  $I_{out}$ " is called) and the current value  $I_{EL}$  which flows to an organic EL device 220 are shown.

[0048] The drive period  $T_c$  is divided into the programming period  $T_{pr}$  and the luminescence period  $T_{el}$ . Here, "the drive period  $T_c$ " means the period updated by a unit of 1 time, and the gradation of luminescence of all the organic EL devices 220 in the display matrix section 200 of it is the same as that of the so-called frame period. Renewal of

gradation is performed for every pixel circuit group for one line, and renewal of sequential of the gradation of the pixel circuit group for N-line is carried out between the drive periods  $T_c$ . For example, when the gradation of all pixel circuits is updated by 30Hz, the drive period  $T_c$  is about 33ms.

[0049] The programming period  $T_{pr}$  is a period which sets up the gradation of luminescence of an organic EL device 220 in the pixel circuit 210. On these specifications, a setup of the gradation to the pixel circuit 210 is called "programming." For example, the drive period  $T_c$  is about 33ms, and when the total N of the gate line  $Y_n$  is 480, the programming period  $T_{pr}$  becomes below about 69 microseconds ( $= 33\text{ms}/480$ ).

[0050] In the programming period  $T_{pr}$ , first, the 2nd gate signal V2 is set as L level, and the 3rd transistor 213 is maintained at an OFF state (closed state). Next, on the data line  $X_m$ , the 1st gate signal V1 is set as H level for the current value  $I_m$  according to luminescence gradation with a sink, and the 1st and the 2nd transistor 211,212 are made into an ON state (open condition). At this time, the single line driver 410 (drawing 4) of this data line  $X_m$  functions as a constant current source which passes the fixed current value  $I_m$  according to luminescence gradation. This current value  $I_m$  is set as the value according to the gradation of luminescence of an organic EL device 220 [ in the range  $R_I$  of a predetermined current value ] as shown in drawing 5 (c).

[0051] It will be in the condition of having held the charge corresponding to the current value  $I_m$  which flows the 4th transistor 214 (drive transistor) in the maintenance capacitor 230. Consequently, between the source/gate of the 4th transistor 214, the electrical potential difference memorized by the maintenance capacitor 230 is impressed. In addition, on these specifications, the current value  $I_m$  of the data signal used for programming is called "the programming current value  $I_m$ ."

[0052] After programming is completed, a gate driver 300 sets the 1st gate signal V1 as L level, and makes the 1st and the 2nd transistor 211,212 an OFF state, and the data-line driver 400 is data signal Iout. It stops.

[0053] In the luminescence period  $T_{el}$ , maintaining the 1st gate signal V1 on L level, and maintaining the 1st and the 2nd transistor 211,212 at an OFF state, the 2nd gate signal V2 is set as H level, and the 3rd transistor 213 is set as an ON state. Since the electrical potential difference corresponding to the programming current value  $I_m$  is beforehand memorized by the maintenance capacitor 230, to it, the almost same current as the programming current value  $I_m$  flows at the 4th transistor 214. Therefore, the current almost same also to an organic EL device 220 as the programming current value  $I_m$  flows, and light is emitted with the gradation according to this current value  $I_m$ . Thus, the pixel circuit 210 of the type with which the electrical potential difference (namely, charge) of the maintenance capacitor 230 is written in by the current value  $I_m$  is called the "current program circuit."

[0054] Drawing 6 is the circuit diagram showing the internal configuration of the single line driver 410. The single line driver 410 is equipped with the data signal generation circuit 420 (it is also called the "control current generating section" or a "current generation circuit") and the addition current circuit 430 (it is also called the "addition current generating section"). The data signal generation circuit 420 and the addition current circuit 430 are connected to juxtaposition between the data line  $X_m$  and touch-down potential.

[0055] The data signal generation circuit 420 has the configuration in which the series connection 421 of a switching transistor 41 and the drive transistor 42 was connected to N grouping (N is two or more integers) juxtaposition. In the example of drawing 6, N is 6. The reference electrical potential difference  $V_{ref1}$  is impressed to the gate of six drive transistors 42 in common. Moreover, the ratio of the gain coefficient  $\beta$  of six drive transistors 42 is set as 1:2:4:8:16:32. In addition, a gain coefficient  $\beta$  is defined by  $\beta = (\mu C_0 W/L)$  as known well. Here,  $\mu$  is the mobility of a carrier, and  $C_0$ . Channel width and L of gate capacitance and W are channel length. Six drive transistors 42 function as a constant current source. Since the current drive capacity of a transistor is proportional to a gain coefficient  $\beta$ , the ratio of the current drive capacity of six drive transistors 42 is 1:2:4:8:16:32.

[0056] ON/OFF of six switching transistors 41 are controlled by the 6-bit data-line driving signal  $D_{data}$  (it is also called an "input signal") given from a controller 100 (drawing 2). As for the least significant bit of the data-line driving signal  $D_{data}$ , the gain coefficient  $\beta$  is supplied to the smallest series connection (that is, the relative value of  $\beta$  1) 421, and, as for the most significant bit, the gain coefficient  $\beta$  is supplied to the most \*\*\*\*\* series connection (that is, the relative value of  $\beta$  32) 421. Consequently, the data signal generation circuit 420 functions as a current source which generates the current value  $I_m$  proportional to the value of the data-line driving signal  $D_{data}$ . The value of the data-line driving signal  $D_{data}$  is set as the value which shows the gradation of luminescence of an organic EL device 220. Therefore, from the data signal generation circuit 420, the data signal which has the current value  $I_m$  according to the gradation of luminescence of an organic EL device 220 is outputted.

[0057] The addition current circuit 430 consists of series connection of a switching transistor 43 and the drive transistor 44. The reference electrical potential difference  $V_{ref2}$  is impressed to the gate electrode of the drive transistor 44. ON/OFF of a switching transistor 43 are controlled by the addition current control signal  $D_p$  given from a controller 100. When a switching transistor 43 is an ON state, the predetermined addition current  $I_p$  according to the reference electrical potential difference  $V_{ref2}$  is outputted on the data line  $X_m$  from the addition current circuit 430.

[0058] Drawing 7 is the explanatory view showing the current value change in the programming period  $T_{pr}$  (drawing 5) at the time of using the addition current circuit 430. Time  $t - 1$ , the output of the programming current  $I_m$  is started from the data signal generation circuit 420, and the output of the addition current  $I_p$  is started also from the addition current circuit 430. Current value Iout outputted from the single line driver 410 at this time It becomes the sum ( $I_m + I_p$ ) of the programming current  $I_m$  and the addition current  $I_p$ . Time  $t -$  in the periods  $t_2 - t_4$  after the addition current  $I_p$  stops by 2, only the programming current  $I_m$  turns into the output current of the single line driver 410. In addition, the periods  $t_1 - t_2$  when the addition current  $I_p$  flows are set as the period which is about [ that the

programming current  $I_m$  flows / in early stages of periods  $t_1$ - $t_4$  ]  $1/4$ . The periods  $t_1$ - $t_2$  when the addition current  $I_p$  flows are set up in early stages of the period when the programming current  $I_m$  flows for suppressing small the effect on the luminescence gradation by the addition current  $I_p$ . In addition, the value of the addition current  $I_p$  is set as the maximum of the programming current  $I_m$ , and the value of mean value extent of the minimum value.

[0059] The output current  $I_{out}$  shown in drawing 7 (a) if it says correctly The current drive capacity of the single line driver 410 is shown, and the actual current value  $I_s$  on the data line  $X_m$  changes, as a continuous line shows to drawing 7 (b). namely, the time  $t$  — in 1, although a big current flows transitionally, it decreases gradually and a current value ( $I_m+I_p$ ) is approached. Time  $t$  — if the addition current circuit 430 becomes off by 2, actual current  $I_s$  will decrease further. however — a time —  $t$  — two — henceforth — \*\*\*\* — a current value — the very thing — being small — since — the data-line capacity  $C_d$  ( drawing 3 ) — charge or the discharging rate — falling — consequently, a current value change — the period of  $t_1$ - $t_2$  — loose — becoming . and the time  $t$  — in 3, the actual current value  $I_s$  decreases even to the programming current value  $I_m$ , and this programming current value  $I_m$  is maintained in periods  $t_3$ - $t_4$ . Therefore, the pixel circuit 210 is programmed with the right programming current value  $I_m$  within the programming period  $T_{pr}$ .

[0060] use of such an addition current  $I_p$  — “ — pass two or more periods (the periods  $t_1$ - $t_2$  of drawing 7 , and periods  $t_2$ - $t_3$ ) when the time amount rate of change of a current value differs actuation of changing the programming current value  $I_m$  from the 1st current value at the time of programming of the last line to the 2nd current value at the time of programming of this line — it is also possible to consider thing” to perform. In addition, change to the 2nd current value from this 1st current value is performed via the 3rd current value ( $I_m+I_p$ ) which is the sum of the programming current  $I_m$  at the time of this programming, and the addition current  $I_p$ .

[0061] The one-point broken line shown in drawing 7 (b) shows the actual current value change when the current drive capacity of the single line driver 410 is fixed ( drawing 7 (c)), without using the addition current  $I_p$ . Since the current value in periods  $t_1$ - $t_2$  is small compared with the case where the addition current  $I_p$  is used at this time, change of a current is also more loose. Therefore, in  $t_4$ , the actual current value  $I_s$  may not reach the programming current value  $I_m$  at the termination time of programming. In such a case, the pixel circuit 210 may not be programmable to right gradation. Or in order to program correctly, the problem that it will be necessary to extend the programming period  $T_{pr}$  is produced. On the other hand, if the addition current  $I_p$  is used, programming correctly within the programming period  $T_{pr}$  is possible.

[0062] Drawing 8 is the explanatory view showing change of the amount  $Q_d$  of charges of the data line  $X_m$  in the programming period  $T_{pr}$ . Drawing 8 draws actuation of drawing 7 in the viewpoint of the amount of charges. In addition, at the time in drawing 7 , if it says correctly,  $t_1$  and  $t_4$  correspond, when the level of the 1st gate signal  $V_1$  changes as shown in drawing 8 .

[0063] Generally, before programming of the pixel circuit group of the  $n$ -th line is started, it depends for the capacity value  $Q_{c0}$  of the data line  $X_m$  on the programming current value  $I_m$  of the data line  $X_m$  in programming of the pixel circuit group of the line of eye watch ( $n-1$ ). Drawing 9 shows the relation between the gradation  $G$  of luminescence of an organic EL device, the current value  $I_m$  (namely, programming current value) of the data line  $X_m$ , and the amount  $Q_d$  of charges of the data line. In the circuitry of the 1st example, Current  $I_m$  increases, so that Gradation  $G$  is high (namely, forge fire with high brightness), and the amount  $Q_d$  (namely, electrical potential difference  $V_d$ ) of charges of the data line tends to fall. gradation  $G_{min}$  with the lowest amount  $Q_d$  of charges \*\*\*\* — the amount of charges equivalent to the electrical potential difference near supply voltage  $V_{dd}$  — becoming — highest gradation  $G_{max}$  \*\*\*\* — it becomes the amount of charges equivalent to the electrical potential difference near touch-down potential. In addition, in the example of drawing 8 (c), the case where the amount  $Q_{d0}$  of charges before this programming initiation is comparatively small is assumed comparatively greatly [ the programming current value  $I_m$  in programming of the direct continued line (namely, ( $n-1$ ), line of eye watch) ] therefore.

[0064] If programming is started by  $t_1$  at the time of drawing 8 , the data line  $X_m$  will charge or discharge according to the output current  $I_{out}$  of the single line driver 410 ( $= I_m+I_p$ ), and the amount  $Q_d$  of charges will increase at a comparatively quick rate. Time  $t$  — if the addition current  $I_p$  is lost by 2 — charge/discharge rate — falling — the change nearby of the amount  $Q_d$  of charges — it becomes loose. However, in  $t_3$ , the amount  $Q_{dm}$  of charges corresponding to the desired programming current value  $I_m$  is reached at the time within the programming period  $T_{pr}$ .

[0065] The addition current circuit 430 functions as the charge-and-discharge acceleration section for accelerating charge or discharge of the data line  $X_m$  so that he can understand from the above explanation. In addition, in this specification, “acceleration of charge or discharge” means the actuation which promotes charge or discharge so that charge or discharge may be completed for a short time rather than the charge or discharge of the data line only by the original desirable current value (this example programming current value  $I_m$ ). Moreover, the addition current circuit 430 can also think that it functions as a resetting means for resetting an acceleration means to accelerate change of the current accompanying change of a data signal, or the amount of charges of the data line  $X_m$ , to a predetermined value.

[0066] As an alternate long and short dash line shows to drawing 8 (c), when there is no addition current  $I_p$ , charge/discharge rate is maintained at the low rate, and has not reached the amount  $Q_{dm}$  of charges corresponding to the desired programming current value  $I_m$  in the telophase  $t_4$  of the programming period  $T_{pr}$  in this example. Therefore, the right programming current  $I_m$  may be unable to be supplied to the pixel circuit 210, and it may be unable to program to right gradation.

[0067] Thus, in this example, it is possible by accelerating charge or discharge of the data line using the addition

current  $I_p$  to perform right programming to the pixel circuit 210. Moreover, programming time can be shortened and improvement in the speed of drive control of an organic EL device 220 can be attained.

[0068] In addition, acceleration of charge of the data line using the addition current  $I_p$  or discharge is usually performed to coincidence about all the data lines  $X_m$  contained in a pixel circuit matrix. However, it may be made to perform acceleration of charge of the data line using the addition current  $I_p$ , or discharge alternatively only to a part of data lines in two or more data lines contained in a pixel circuit matrix. For example, when the amount  $Q_{d0}$  (drawing 8) of charges of the  $m$ -th data line  $X_m$  at the time of initiation of programming is close enough to the amount  $Q_{dm}$  of charges corresponding to the desired programming current  $I_m$ , it is not necessary to use the addition current  $I_p$ . A controller 100 compares mutually the programming current value in the line of eye watch ( $n-1$ ) with the programming current value in the  $n$ -th line about each data line, and as long as the difference is less than a predetermined threshold, specifically, you may judge that the addition current  $I_p$  is not used at the time of programming of the  $n$ -th line. Moreover, the value of the addition current  $I_p$  may be changed according to the difference of these programming current values. As long as it puts in another way, you may make it establish a means to determine the current value of the addition current  $I_p$  the last value of the programming current value  $I_m$ , and this time according to a difference with a value, and a means to supply the determined addition current value  $I_p$  to each data line  $X_m$ . According to this configuration, the addition current value  $I_p$  can be used more effectively and improvement in the speed of a drive can be promoted.

[0069] Or you may judge that the addition current  $I_p$  is used only when this programming current value  $I_m$  is smaller than a predetermined threshold, and the addition current  $I_p$  is not used when the programming current value  $I_m$  is larger than a threshold. This reason is that it can attain the desired programming current value  $I_m$  at a high speed enough even if it does not use the addition current  $I_p$  since charge or discharge of the data line  $X_m$  is fully early performed when the programming current value  $I_m$  is large.

[0070] Only when the sum (the 3rd current value) of this programming current value  $I_m$  smaller than the programming current value (the 1st current value) of last time [current value / (the 2nd current value) / this / programming] and the addition current value  $I_p$  is smaller than the last programming current value, instead, it is good also as using the addition current  $I_p$ . These three current values can also be set as various relation other than this. For example, it is good though it is a current value between the 1st current value and the 2nd current value about the 3rd current value. Moreover, it is good also considering the absolute value of the time amount rate of change of the current value from the 1st current value to the 3rd current value as a larger thing than the absolute value of the time amount rate of change of the current value from the 3rd current value to the 2nd current value. Furthermore, it is good also considering the absolute value of the difference of the 1st current value and the 3rd current value as a larger thing than the absolute value of the difference of the 3rd current value and the 2nd current value.

[0071] It is desirable to make a judgment whether the addition current  $I_p$  is used for every data line. However, there is an advantage that control of the thing which always uses the addition current  $I_p$ , then the whole display becomes simple, irrespective of the value of the programming current at the time of programming of the direct continued line.

[0072] As mentioned above, in this example, it is possible by adding the addition current  $I_p$  to the programming current  $I_m$  in early stages of a programming period to perform exact programming for a short time. Or it is possible to shorten programming time and to attain improvement in the speed of drive control of an organic EL device 220. Since improvement in the speed of drive control is especially required with enlargement and high-resolution-izing of a display panel, above-mentioned effectiveness is remarkable in a large-sized display panel or a high resolution display panel.

[0073] B. The 2nd example (2 of addition \*\*\*\*\*): drawing 10 is the block diagram showing the outline configuration of the indicating equipment as the 2nd example of this invention. As for this indicating equipment, it differs from the 1st example in that data-line driver 400a is prepared in the power-source potential  $V_{dd}$  side. Moreover, the internal configuration of single line driver 410a and the internal configuration of pixel circuit 210a also differ from the 1st example so that it may explain below.

[0074] Drawing 11 is the circuit diagram showing the internal configuration of pixel circuit 210a. This pixel circuit 210a is the so-called SANOFU type of current program circuit. This pixel circuit 210a has an organic EL device 220, four transistors 241-244, and maintenance capacitors 230. In addition, four transistors 241-244 are the p channel molds FET.

[0075] The 1st transistor 241, the maintenance capacitor 230, and the 2nd transistor 242 are connected [this order] to the data line  $X_m$  at the serial. The drain of the 2nd transistor 242 is connected to the organic EL device 220. The 1st subgate line  $V_1$  is connected to the gate of the 1st and the 2nd transistor 241,242 in common.

[0076] Between the power-source potential  $V_{dd}$  and touch-down potential, the series connection of the 3rd transistor 243, the 4th transistor 244, and an organic EL device 220 is inserted. The drain of the 3rd transistor 243 and the source of the 4th transistor 244 are connected also to the drain of the 1st transistor. The 2nd gate line  $V_2$  is connected to the gate of the 3rd transistor 243. Moreover, the gate of the 4th transistor 244 is connected to the source of the 2nd transistor 242. The maintenance capacitor 230 is connected between the source of the 4th transistor 244, and the gate.

[0077] The 1st and the 2nd transistor 241,242 are switching transistors used in case a desired charge is accumulated in the maintenance capacitor 230. The 3rd transistor 243 is a switching transistor maintained at an ON state in the luminescence period of an organic EL device 220. Moreover, the 4th transistor 244 is a drive transistor for controlling the current value which flows to an organic EL device 220. The current value of the 4th transistor

244 is controlled by the amount of charges held at the maintenance capacitor 230.

[0078] Drawing 12 is a timing chart which shows the usual actuation of pixel circuit 210a of the 2nd example. In this actuation, the logic of gate signals V1 and V2 is reversed from actuation of the 1st example shown in drawing 5. Moreover, in the 2nd example, in the programming period Tpr, the programming current Im flows to an organic EL device 220 via the 1st and the 4th transistor 241,244 so that he can understand from the circuitry of drawing 11. Therefore, in the 2nd example, an organic EL device 220 emits light also in the programming period Tpr. Thus, an organic EL device 220 may emit light, or it is not necessary to emit light like the 1st example in the programming period Tpr.

[0079] Drawing 13 is the circuit diagram showing single line driver 410a of the 2nd example. This single line driver 410a is connected to the power-source potential Vdd side of the data line Xm. For this reason, the drive transistor 42 of data signal generation circuit 420a and the drive transistor 44 of addition current circuit 430a differ from the 1st example shown in drawing 6 with the point constituted from a p channel mold FET by each. Other configurations are the same as the 1st example.

[0080] Drawing 14 shows the relation between the gradation G of luminescence of the organic EL device in the 2nd example, the current value Im of the data line Xm, and the amount Qd of charges of the data line. In the 2nd example, contrary to the 1st example, since single line driver 410a is prepared in the power-source potential Vdd side of the data line Xm, the relation between Gradation G and the amount Qd (namely, electrical potential difference Vd) of charges of the data line Xm has reversed the 1st example. That is, the amount Qd (namely, electrical potential difference Vd) of charges of the data line tends to rise, so that Gradation G is high (namely, forge fire with high brightness). gradation Gmin with the lowest amount Qd of charges \*\*\*\* — the amount of charges equivalent to the electrical potential difference near a touch-down electrical potential difference — becoming — highest gradation Gmax \*\*\*\* — it becomes the amount of charges equivalent to the electrical potential difference near the power-source potential Vdd.

[0081] Drawing 15 is the explanatory view showing change of the amount Qd of charges of the data line Xm in the programming period Tpr in the 2nd example. This change is the same as change in the 1st example and the essential target which showed drawing 8. However, that the amount Qd0 of charges before programming initiation is comparatively small in drawing 15 (c) means conversely that the programming current value Im in programming of the direct continued line (namely, (n-1), line of eye watch) is comparatively small as the 1st example.

[0082] It has the effectiveness as the 1st example that the display of this 2nd example is also the same. That is, it is possible by adding the addition current Ip to the programming current Im in early stages of the programming period Tpr to perform exact programming to pixel circuit 210a for a short time. Or it is possible to shorten programming time and to attain improvement in the speed of drive control of an organic EL device 220.

[0083] C. The 3rd example (3 of addition \*\*\*\*\*) : drawing 16 is the circuit diagram showing single line driver circuit 410b of the 3rd example. Although the data signal generation circuit 420 in this single line driver 410b is the same as the 1st example shown in drawing 6, the configuration of addition current circuit 430b differs from the 1st example. That is, this addition current circuit 430b has 2 sets of series connection of a switching transistor 43 and the drive transistor 44, and these are mutually connected to juxtaposition. The ratio of gain coefficient betac of two drive transistors 44 is set as 1:2. Moreover, the addition current control signal Dp is also supplied as a 2-bit signal. When this addition current circuit 430b is used, it is possible to set it as either of four level according to four values 0-3 to which the addition current control signal Dp can take the addition current value Ip at arbitration.

[0084] Drawing 17 is the explanatory view showing actuation of the programming period Tpr at the time of using addition current circuit 430b of the 3rd example. Here, the addition current value Ip is changing from the 1st higher level Ip2 to the 2nd lower level IP 1. Consequently, it may compare with the 1st example or the 2nd example, and the data line may be able to be charged or discharged more early. When using an addition current so that he can understand also from this example, an addition current value is changed to two or more steps, and it is the output current Iout of the data line Xm. You may make it make it change more than a three-stage.

[0085] Moreover, as well as the 1st example when addition current circuit 430b of drawing 16 is used, it is possible to determine the level of the addition current value Ip according to the programming current value over the direct continued line and the programming current value over this line. If it carries out like this, it is possible to use alternatively the suitable addition current value according to a programming current value.

[0086] In addition, addition current circuit 430b using the addition current value Ip of such a multiple value is applicable also to the 2nd example.

[0087] D. The modification using an addition current : about use of an addition current, the following various deformation is possible.

[0088] D1: If there is no need of preparing an addition current circuit into the single line driver 410 and it connects with the data line Xm, preparing in other locations is also possible. Moreover, one addition current circuit may be prepared to two or more data lines instead of preparing one addition current circuit for every data-line Xm.

[0089] D2: A bigger current value than the programming current value Im is generated in early stages of a programming period, and you may make it switch to the programming current value Im after progress of predetermined time by the data signal generation circuit 420 again, without preparing an addition current circuit.

[0090] What is necessary is just to make it pass a bigger current than the programming current value Im to the data line in the early stages of programming generally, in case an addition current is used so that he can understand also from various kinds of the above examples and modifications. By carrying out like this, charge or discharge of the data line can be promoted, and exact programming and a high-speed drive are attained.

[0091] E. The 4th example (precharge) : drawing 18 is the block diagram showing the configuration of the indicating equipment as the 4th example of this invention. This indicating equipment establishes the precharge circuit 600 in each data line  $X_m$  ( $m=1-M$ ) of the indicating equipment of the 1st example shown in drawing 3, respectively, and other configurations are the same as what was shown in drawing 3. However, as for the electrostatic capacity  $C_d$  of the data line, illustration is expedient-upper-omitted. In addition, it is also possible to use what does not have the addition current circuit 430 (drawing 6) as a single line driver 410.

[0092] The precharge circuit 600 is connected to each data line  $X_m$  in the location between the display matrix section 200 and the data-line driver 400, respectively. The precharge circuit 600 consists of series connection of the precharge power source \*\*\*\* and switching transistor 610 which are a source of a constant voltage. In this example, a switching transistor 610 is the n channel mold FET, and that source is connected to the data line  $X_n$ . The precharge control signal Pre is inputted into the gate of each switching transistor 610 in common from the controller 100 (drawing 2). The potential of the precharge power source \*\*\*\* is set as the drive power-source potential  $V_{dd}$  (drawing 4) of the pixel circuit 210. However, the power circuit which can adjust the precharge electrical potential difference \*\*\*\* to arbitration may be adopted.

[0093] The precharge circuit 600 is a circuit for shortening the time amount which performs charge or discharge of each data line  $X_m$  before completion of programming, and programming takes. If it puts in another way, the precharge circuit 600 will function as the charge-and-discharge acceleration section for accelerating charge or discharge of the data line  $X_m$ . Moreover, the precharge circuit 600 can also think that it functions as a resetting means for resetting an acceleration means to accelerate change of the current accompanying change of a data signal, or the amount of charges of the data line  $X_m$ , to a predetermined value.

[0094] Drawing 19 is the explanatory view showing actuation of the programming period  $T_{pr}$  in the 4th example. In this example, in periods  $t_{11}$ - $t_{12}$ , the precharge control signal Pre serves as H level before activation of programming in periods  $t_{13}$ - $t_{15}$ , and the charge or discharge (precharge) by the precharge circuit 600 is performed. By this precharge, the amount  $Q_d$  of charges of the data line  $X_m$  reaches a value predetermined [ according to the precharge electrical potential difference \*\*\*\* (drawing 18) ]. If it puts in another way, the data line  $X_m$  will reach to an electrical potential difference almost equal to the precharge electrical potential difference \*\*\*\*. Then, if programming is performed in periods  $t_{13}$ - $t_{15}$ , in  $t_{14}$ , the amount  $Q_d$  of charges of the data line  $X_n$  will reach the amount  $Q_{dm}$  of charges corresponding to the desired programming current value  $I_m$  the time of being within the programming period  $T_{pr}$ .

[0095] The one-point broken line of drawing 19 (d) shows change of the amount of charges when using neither precharge nor an addition current. In this case, in the telophase of the programming period  $T_{pr}$ , the amount of charges of the data line has not reached the amount  $Q_{dm}$  of charges corresponding to the desired programming current value  $I_m$ . Therefore, the right programming current  $I_m$  may be unable to be supplied to the pixel circuit 210, and it may be unable to program to right gradation.

[0096] Thus, in this example, it is possible by precharging and accelerating charge or discharge of the data line to set up right luminescence gradation to the pixel circuit 210. Moreover, programming time can be shortened and improvement in the speed of drive control of an organic EL device 220 can be attained.

[0097] In addition, when the data-line driver 400 is formed in the touch-down potential side of the data line  $X_m$ , there are so many amounts  $Q_d$  of charges of the data line that the programming current value  $I_m$  is small as shown in drawing 9 mentioned above, and the electrical potential difference  $V_d$  is also large. In this case, as for the precharge electrical potential difference \*\*\*\*, it is desirable to set it as the comparatively high electrical-potential-difference value equivalent to the comparatively small programming current value  $I_m$  (namely, comparatively low luminescence gradation).

[0098] There are also so few amounts  $Q_d$  of charges of the data line that the programming current value  $I_m$  is small as it is shown in drawing 14 mentioned above on the other hand, when the data-line driver 400 is formed in the power-source potential side of the data line  $X_m$ , and the electrical potential difference  $V_d$  is also small. In this case, as for the precharge electrical potential difference \*\*\*\*, it is desirable to set it as the comparatively low electrical-potential-difference value equivalent to the comparatively small programming current value  $I_m$  (namely, comparatively low luminescence gradation).

[0099] As for the precharge electrical potential difference \*\*\*\*, specifically, it is desirable to be set up so that the data line can be precharged to the electrical-potential-difference value equivalent to a low tonal range below the median of luminescence gradation. It is desirable to set up the precharge electrical potential difference \*\*\*\* so that the data line can be precharged to the electrical-potential-difference value which is equivalent to the gradation near the lowest luminescence gradation that is not zero especially. Here, when for example, whole floor tone range is 0-255, as for "the lowest gradation near the luminescence gradation that is not zero", the gradation value means the gradation of about one to ten range. If it carries out like this, also when the programming current value  $I_m$  is small, programming at a high speed enough is possible.

[0100] Decision whether it precharges or not can be determined according to the programming current value over the direct continued line, and the programming current value over this line as well as the case where various kinds of examples and modifications using the addition current mentioned above explain. For example, when the amount  $Q_{d0}$  (drawing 19) of charges of the  $m$ -th data line  $X_m$  at the time of initiation of programming is close enough to the amount  $Q_{dm}$  of charges corresponding to the desired programming current  $I_m$ , it is not necessary to perform precharge about the data line  $X_m$ . Or you may judge that precharge is used only when this programming current value  $I_m$  is smaller than a predetermined threshold, and precharge is not used when this programming current value

$I_m$  is larger than a threshold. This reason is that it can attain the desired programming current value  $I_m$  at a high speed enough even if it does not precharge since charge or discharge of the data line  $X_m$  is fully early performed when the programming current value  $I_m$  is large.

[0101] In addition, when judging whether it precharges for every data line, it can precharge alternatively. However, if it is always made to precharge to all the data lines, there is an advantage that control of the whole display becomes simple.

[0102] In addition, the electrochromatic display is equipped with the pixel circuit of 3 classification by color of RGB. In this case, it is desirable to constitute equipment so that the precharge electrical potential difference \*\*\*\* can be independently set up for every color. It is desirable to prepare three power circuits for precharge so that the precharge electrical potential difference \*\*\*\* for which it was suitable about the data line for R, the data line for B, and the data line for G, respectively can specifically be set up. Moreover, when the pixel circuit of 3 classification by color is connected to the same data line, it is desirable to adopt the source circuit of good transformation which can change output voltage as a power circuit for precharge. If it enables it to set up the precharge electrical potential difference \*\*\*\* according to an individual for every color, precharge actuation can be performed more efficiently.

[0103] F. The modification about precharge timing : drawing 20 is the explanatory view showing the modification of a precharge period. In this example, the period  $T_{pc}$  (it is called "the precharge period  $T_{pc}$ ") when the precharge signal Pre serves as ON is extended till the stage when the 1st gate signal  $V_1$  laps with the part in early stages of the period used as ON. In this case, since two switching transistors 211,212 for setting in the second half of the precharge period  $T_{pc}$ , and charging or discharging the maintenance capacitor 230 ( drawing 4 ) will be in an ON state, it is possible to precharge this maintenance capacitor 230 to the data line  $X_m$  and coincidence. Therefore, when the electrostatic capacity of the maintenance capacitor 230 cannot be disregarded compared with the electrostatic capacity  $C_d$  of the data line  $X_m$ , it is effective in shortening the time amount which subsequent programming takes.

[0104] However, if it is made to precharge like drawing 19 before starting actual programming, precharge may be able to suppress smaller the effect which it has on the amount of stored charge of the maintenance capacitor 230.

[0105] In addition, in drawing 20 , the programming current  $I_m$  is kept at 0 until the precharge period  $T_{pc}$  expires. This reason is that it consumes useless power since a part of this current will flow also in the precharge circuit 600, if the programming current  $I_m$  is passed at the precharge period  $T_{pc}$ . However, when it is extent which can disregard the increment in the power consumption by this, you may make it pass the programming current  $I_m$  within the precharge period  $T_{pc}$ .

[0106] Drawing 21 is the explanatory view showing other modifications of a precharge period. In this example, the precharge period  $T_{pc}$  is started, after the 1st gate signal  $V_1$  serves as ON. Also in this case, it is possible to precharge the maintenance capacitor 230 to the data line  $X_m$  and coincidence. Also in this example, it is desirable to keep the programming current  $I_m$  at 0 until the precharge period  $T_{pc}$  expires.

[0107] A precharge period may be set as the period containing a part of early stages of the period when it may be set up at before the period when programming of a pixel circuit is performed (example of drawing 19 ), or programming of a pixel circuit is performed so that he can understand from the above explanation (in the case of drawing 20 and drawing 21 ). Here, "the period when programming is performed" means the period which has a gate signal  $V_1$  in an ON state, and has the switching transistor (for example, 211,212 of drawing 4 ) which connects the data line  $X_m$  and the maintenance capacitor 230 in an ON state. If it puts in another way, as for precharge, it is desirable to perform in the specific precharge period before a programming period is completed. Since precharge will be performed before are recording (storage of an electrical potential difference) of the charge to the maintenance capacitor 230 is completed if it carries out like this, precharge can prevent that become a cause and the amount of stored charge of the maintenance capacitor 230 shifts from a desired value.

[0108] G. The modification about arrangement of a precharge circuit : drawing 22 thru/or drawing 25 show the various modifications of arrangement of the precharge circuit 600. In the example of drawing 22 , two or more precharge circuits 600 are formed in display matrix section 200b. This configuration is a configuration of having added the precharge circuit 600 to the display matrix section 200 of the 1st example shown in drawing 3 . In the example of drawing 23 , two or more precharge circuits 600 are formed in data-line driver 400c. The example of drawing 24 is also established for two or more precharge circuits 600 in 200d of display matrix sections. However, the configuration of drawing 24 is a configuration of having added the precharge circuit 600 to display matrix section 200a of the 2nd example shown in drawing 10 . In the example of drawing 25 , two or more precharge circuits 600 are formed in data-line driver 400e. Actuation of the circuit of drawing 22 - drawing 25 is almost the same as actuation of the 4th example mentioned above.

[0109] Like the example of drawing 22 or drawing 24 , when the precharge circuit 600 is formed in the display matrix section 200, the precharge circuit 600 also consists of the same TFT(s) as a pixel circuit. On the other hand, it is also possible to also create by TFT in the display panel which includes the precharge circuit 600 for the display matrix section 200, when the precharge circuit 600 is formed out of the display matrix section 200 like the example of drawing 23 or drawing 25 , and to form the precharge circuit 600 in possible or IC with the separate display matrix section 200.

[0110] Drawing 26 shows the example of other displays equipped with the precharge circuit 600. In this indicating equipment, one single line driver 410, one precharge circuit 600, and a shift register 700 and \*\* are prepared instead of two or more single line drivers 410 which can be set in the configuration of drawing 23 , and two or more precharge circuits 600. Moreover, the switching transistor 250 is formed in each data line of 200f of display matrix

sections. One terminal of a switching transistor 250 is connected to each data line  $X_m$ , and the other-end child is connected to the output signal line 411 of the single line driver 410 in common. It connects with this output-signal line 411 also in the precharge circuit 600. The shift register 700 supplies ON / off control signal to the switching transistor 250 of each data line  $X_m$ , and makes sequential selection of every one data line  $X_m$  by this.

[0111] The pixel circuit 210 is updated by point sequential in this display. That is, only one pixel circuit 210 which exists in the intersection of one gate line  $Y_n$  chosen with the gate driver 300, the one data line  $X_m$  chosen with the shift register 700, and \*\* is updated by one programming. for example, one sequential programming is performed at a time about the pixel circuit 210 of  $M$  individual chosen by the  $n$ -th gate line  $Y_n$ , and every one pixel circuit 210 of  $M$  individual on the gate line of eye watch  $(n+1)$  of a degree is programmed after the termination. On the other hand, in various kinds of examples and modifications which were mentioned above, it is the point that the pixel circuit group for one line was programmed by coincidence (namely, line sequential), and the display and actuation which were shown in drawing 26 differ from each other.

[0112] the display of drawing 26 — like — a dot order — as well as the 4th example mentioned above when programming the pixel circuit 210 next, by precharging the data line before completion of programming of each pixel circuit, it is possible to perform right programming in the pixel circuit 210, or programming time can be shortened and improvement in the speed of drive control of an organic EL device 220 can be attained.

[0113] Also in the equipment of drawing 26, the precharge circuit 600 is the point which can accelerate charge or discharge of two or more data lines  $X_m$  ( $m=1-M$ ), and is common in the example and modification which were mentioned above. However, to coincidence, the precharge circuit 600 of drawing 26 charges, or does not necessarily discharge, and it can only charge or discharge one [ at a time ] two or more data lines. Not only when that circuit can accelerate two or more charge or discharge about the data line to coincidence but when it can accelerate one sequential charge or discharge at a time, in this specification, \*\*\*\* [ circuit / a certain ] "charge or discharge of two or more data lines is accelerable" is included, so that he can understand also from this explanation.

[0114] In addition, although drawing 26 explained the example in the case of precharging to the data line in the indicating equipment which performs point sequential programming, as a means to perform acceleration of charge of the data line, or discharge in such equipment, the addition current circuit mentioned above is available similarly. For example, since the single line driver 410 of drawing 26 has circuitry shown in drawing 6, it can generate the addition current  $I_p$  using the addition current circuit 430. However, there is no need of constituting a circuit so that both precharge and an addition current can be used for coincidence, and the circuitry which can use only either may be adopted.

[0115] H. The example of application to electronic equipment : the indicating equipment using an organic EL device is applicable to the personal computer of a mobile mold, a cellular phone, and various electronic instruments, such as a digital still camera.

[0116] Drawing 27 is the perspective view showing the configuration of the personal computer of a mobile mold. The personal computer 1000 is equipped with the body section 1040 equipped with the keyboard 1020, and the display unit 1060 using an organic EL device.

[0117] Drawing 28 is the perspective view of a cellular phone. This cellular phone 2000 is equipped with two or more manual operation buttons 2020, the ear piece 2040, the speaker 2060, and the display panel 2080 that used the organic EL device.

[0118] Drawing 29 is the perspective view showing the configuration of the digital still camera 3000. In addition, it is shown in [ connection / with an external instrument ] simple. The digital still camera 3000 generates an image pick-up signal for the light figure of a photographic subject by the photo electric conversion of image sensors, such as CCD (Charge Coupled Device), to the usual camera exposing a film according to the light figure of a photographic subject. Here, the display panel 3040 which used the organic EL device is formed in the tooth back of the case 3020 of the digital still camera 3000, and a display is performed based on the image pick-up signal by CCD. For this reason, a display panel 3040 functions as FAIDA which displays a photographic subject. Moreover, the light-receiving unit 3060 containing an optical lens, CCD, etc. is formed in the case 3020 observation-side (setting to drawing rear-face side).

[0119] Here, when a photography person checks the photographic subject image displayed on the display panel 3040 and does the depression of the shutter carbon button 3080, the image pick-up signal of CCD at the time is transmitted and stored at the memory of the circuit board 3100. Moreover, if it is in this digital still camera 3000, the video signal output terminal 3120 and the input/output terminal 3140 for data communication are formed in the side face of a case 3020. And as shown in drawing, a personal computer 4400 is connected to the input/output terminal 3140 for the latter data communication for a television monitor 4300 again at the former video signal output terminal 3120 if needed, respectively. Furthermore, the image pick-up signal stored in the memory of the circuit board 3100 is outputted to a television monitor 4300 and a personal computer 4400 by predetermined actuation.

[0120] In addition, as electronic equipment, the personal computer of drawing 27, the device equipped with the video tape recorder of television, a viewfinder mold, or a monitor direct viewing type, the car navigation equipment, the pager, the electronic notebook, the calculator, the word processor, the workstation, the TV phone, POS terminal, and touch panel other than the cellular phone of drawing 28 and the digital still camera of drawing 29, etc. can be mentioned. The above-mentioned display using the organic EL device as a display of these electronic equipment of various kinds of is applicable.

[0121] I. — other modification: — although all the transistors should be constituted from various kinds of examples and modifications of which I1:\*\*\*\* was done by FET, it is also possible to replace a part or all transistors by the

bipolar transistor or the switching element of other classes. The gate electrode of FET and the base electrode of a bipolar transistor are equivalent to the "control electrode" in this invention. as these transistors of various kinds of — a thin film transistor (TFT) — in addition, the transistor of the silicon base is also employable.

[0122] I2: Although the display matrix section 200 should have 1 set of pixel circuit matrices in various kinds of examples and modifications which were mentioned above, it is good also as that in which the display matrix section 200 has two or more sets of pixel circuit matrices. For example, in case a large-sized panel is constituted, the display matrix section 200 is classified into two or more adjoining fields, and you may make it establish 1 set of pixel circuit matrices for every field, respectively. Moreover, you may make it establish 3 sets of pixel circuit matrices equivalent to three colors of RGB in the one display matrix section 200. When two or more pixel circuit matrices (unit circuit matrix) exist, it is possible to apply the example mentioned above for every matrix and a modification.

[0123] I3: Although the programming period  $T_{pr}$  and the luminescence period  $T_{el}$  were divided in the pixel circuit used in the example and modification of the various kinds mentioned above as shown in drawing 5, it is also possible to use a pixel circuit in which the programming period  $T_{pr}$  falls on a part of luminescence period  $T_{el}$ . To such a pixel circuit, programming is performed in early stages of the luminescence period  $T_{el}$ , the gradation of luminescence is set up, and luminescence continues with the set-up gradation after that. Also about the equipment using such a pixel circuit, by accelerating the data line by the addition current or precharge, it is possible to set right luminescence gradation as a pixel circuit, or programming time can be shortened and improvement in the speed of drive control of an organic EL device can be attained.

[0124] I4: Although the example and modification of the various kinds mentioned above explained the example about the display which has the pixel circuit of a current programming mold, this invention is applicable also to the display which has the pixel circuit of an electrical-potential-difference programming mold. To the pixel circuit of an electrical-potential-difference programming mold, programming (setup of luminescence gradation) is performed according to the electrical-potential-difference value of the data line. Also in the indicating equipment which has the pixel circuit of an electrical-potential-difference programming mold, acceleration of charge of the data line using an addition current or precharge or discharge can be performed.

[0125] However, with the display using the pixel circuit of a current programming mold, since a programming current value becomes very small when luminescence gradation is low, programming may take great time amount. Therefore, when this invention is applied to the indicating equipment using the pixel circuit of a current programming mold, the effectiveness by acceleration of charge of the data line or discharge is more remarkable.

[0126] I5: In various kinds of examples and modifications which were mentioned above, although the gradation of luminescence of an organic EL device 220 should be adjusted, this invention is applicable also to the display which generates constant current and performs monochrome display (binary display). Moreover, this invention can be applied also when driving an organic EL device using the passive matrix driving method. However, since the demand to improvement in the speed of a drive is more strong to the indicating equipment in which multi-tone adjustment is possible, and the indicating equipment using the active-matrix driving method, the effectiveness of this invention is also more remarkable. Furthermore, this invention can be applied not only the display that arranged the pixel circuit in the shape of a matrix but when other arrays are adopted.

[0127] I6: Although the example mentioned above and the modification explained the example of the display which used the organic EL device, this invention is applicable also to the display and electronic instrument which used light emitting devices other than an organic EL device. For example, it is applicable also to the equipment which has the light emitting devices (LED, FED (Field Emission Display), etc.) of other classes which can adjust the gradation of luminescence according to a drive current.

[0128] I7: This invention is applicable also to the component of other current drive molds other than a light emitting device further, MAG RAM (MRAM) exists as a component of such a current drive mold. Drawing 30 is the block diagram showing the configuration of the memory apparatus using MAG RAM.

[0129] This memory apparatus has the memory-cell-matrix section 820, the word line driver 830, and the bit line driver 840. The memory-cell-matrix section 820 has two or more magnetic memory cells 810 arranged in the shape of a matrix. Two or more bit lines  $X_1$  extended along the direction of a train,  $X_2$  —, and two or more word lines  $Y_1$  and  $Y_2$  — which are extended along with a line writing direction are connected to the matrix of the magnetic memory cell 810, respectively. The memory-cell-matrix section 820 supports the display matrix section 200 so that he can understand, if this drawing 30 is compared with drawing 3 of the 1st example. Moreover, the word line driver 830 supports to a gate driver 300, and the bit line driver 840 supports [ the magnetic memory cell 810 ] the pixel circuit 210 at the data-line driver 400, respectively.

[0130] Drawing 31 is the explanatory view showing the configuration of the magnetic memory cell 810. This magnetic memory cell 810 has the configuration in which the barrier layer 813 which consists of an insulator was inserted between two electrodes 811,812 which consist of ferromagnetic metal layers. MAG RAM is made to perform a data storage using the phenomenon depending on the sense of the magnetization  $M_1$  and  $M_2$  of the ferromagnetic metal of the upper and lower sides of the magnitude of the tunnel current, when tunnel current is passed through a barrier layer 813 between two electrodes 811,812. Specifically, "0" and "1" are judged for the data memorized by measuring the electrical potential difference  $V$  between two electrodes 811,812 (or resistance).

[0131] One electrode 812 is used as a typical floor to which the sense of the magnetization  $M_2$  was fixed, and the electrode 811 of another side is used as a data-logging layer. Informational record is performed by changing the sense of the magnetization  $M_1$  of an electrode 811 by the field which generates the data current  $I_{data}$  according to a sink and this in a bit line  $X_m$  (write-in electrode). Read-out of recording information is performed by reading

electrically a sink, and the tunnel resistance and the electrical potential difference at this time for the current of hard flow to a bit line  $X_m$  (write-in electrode).

[0132] In addition, the memory apparatus explained by drawing 30 and drawing 31 is an example of equipment which used such MAG RAM, and various things are proposed about the configuration of MAG RAM, informational record, or the read-out approach.

[0133] This invention is applicable also to the electronic instrument using the current driver element which is not by the light emitting device like this MAG RAM. That is, generally this invention is applicable to the electronic instrument which used the current driver element.

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[Translation done.]



前記電流値の付加は、前記各発光素子の発光の検出に応じたデータ値が生成される期間の初期に行われる、電圧発生装置。

【請求項14】 請求項12または13記載の電圧発生装置であって、

前記付加電圧回路は、各データ値に対して前記データ値の生成期間と並列に接続されたトランジスタを含む、電圧発生装置。

【請求項15】 発光素子と前記発光素子の発光の検出を制御するための回路とをそれぞれ含む複数の単位回路がマトリクス状に接続された単位回路マトリクスと、各発光素子の発光の検出に応じたデータ値を各単位回路に供給するための複数のデータ値と、各単位回路マトリクス回路のデータ値と、を備えたアナログマトリクス回路の電圧発生装置の駆動方法であって、

少なくとも1つの単位回路に前記データ値を介して前記データ値を供給する際に、前記データ値の発光または放電を増加することを特徴とする電圧発生装置の駆動方法。

【請求項16】 請求項15記載の方法であって、前記単位回路による前記発光素子の発光検出の期間は、電圧として供給される前記データ値に依存して行われる、方法。

【請求項17】 請求項15または16記載の方法であって、

前記発光素子または放電の増加は、所定のプリチャージ期間において前記データ値をプリチャージすることによって行われる、方法。

【請求項18】 請求項17記載の方法であって、

(1) 所定の第1の期間において、前記データ値により前記単位回路の放電を行う過程と、(11) 前記第1の期間の後の第2の期間において、前記単位回路の放電状態に依って前記発光素子が発光する過程と、を備え、前記プリチャージ期間は、前記第2の期間以外の期間であって前記第1の期間が完了する前に設定される、方法。

【請求項19】 請求項18記載の方法であって、前記プリチャージ期間は、前記第1の期間の開始される以前に設定される、方法。

【請求項20】 請求項18記載の方法であって、前記プリチャージ期間は、前記第1の期間の初期の一部を含む期間に設定される、方法。

【請求項21】 請求項17ないし20のいずれかに記載の方法であって、

前記プリチャージは、発光期間の中央値以下の低い期間に相当する電圧値に前記データ値を充電または放電するように行われる、方法。

【請求項22】 請求項21記載の方法であって、

前記プリチャージは、ゼロでない低い発光検出の同期の初期に相当する電圧に前記データ値を充電または放電する。

放電するように行われる、方法。

【請求項23】 請求項17ないし22のいずれかに記載の方法であって、

各単位回路は、複数の色成分毎にそれぞれ設けられており、

前記プリチャージは、各色成分毎に異なる電圧で前記データ値を充電または放電するように行われる、方法。

【請求項24】 請求項15または16記載の方法であって、

前記発光素子または放電の増加は、前記各発光素子の発光の検出に応じたデータ値の電圧値に、前記発光素子または放電の増加のための電圧値を付加することによって行われる、方法。

【請求項25】 請求項24記載の方法であって、

前記電圧値の付加は、前記各発光素子の発光の検出に応じたデータ値が生成される期間の初期に行われる、方法。

【請求項26】 複数の電流の電流値に依って動作が制御される複数の電圧発生装置と、

各電圧発生装置に、前記電圧発生装置の動作状態を規定するデータ値を供給するためのデータ値と、

前記データ値に前記データ値を出力するためのデータ値発生回路と、

前記データ値を介して前記データ値が前記電圧発生装置に供給するための電圧発生装置と、前記データ値の充電または放電を増加するための電圧発生装置と、を備える電子装置。

【請求項27】 請求項26記載の電子装置であって、前記電圧発生装置は、前記複数のデータ値をプリチャージすることが可能なプリチャージ回路を含む、電子装置。

【請求項28】 請求項26記載の電子装置であって、前記電圧発生装置は、前記電圧発生装置の動作状態に依って前記データ値の電流値に、前記データ値の充電または放電を増加するための電圧値を付加する付加電圧回路を含む、電子装置。

【請求項29】 入力信号に対して電圧を生成する電圧発生回路と、電圧発生素子を備えた単位回路と、前記電圧を前記単位回路に供給するデータ値と、を含む電圧発生装置であって、前記入力信号の変化に伴う前記電圧の変化を増加する増加回路を備えることを特徴とする電圧発生装置。

【請求項30】 前記増加回路は、前記データ値の電圧を、所定の電圧に設定するプリチャージ回路であることを特徴とする請求項29記載の電圧発生装置。

【請求項31】 前記増加回路は、前記データ値に放れる電流の一部の電流値となる付加電圧回路であることを特徴とする請求項29記載の電圧発生装置。

【請求項32】 前記入力信号の変化に伴う前記電圧の変化に応じて、前記増加回路の使用の要否を判断する判断回路を備えていることを特徴とする請求項29乃至31記載の電圧発生装置。

至31の付加に記録の電圧発生装置。

【請求項33】 入力信号に対して電圧を生成する電圧発生回路と、電圧発生素子を備えた単位回路と、前記電圧を前記単位回路に供給するデータ値と、を含む電圧発生装置の駆動方法であって、

前記入力信号の変化に伴う前記電圧の電流値を第1の電流値から第2の電流値に変化させる操作を、電流値の時間変化の異なる複数の期間を経て行うことを特徴とする電圧発生装置の駆動方法。

【請求項34】 前記第1の電流値から第2の電流値に変化させる操作は、前記データ値を所定の電圧に設定するプリチャージ期間によって規定される第3の電流値を経由して行われることを特徴とする請求項33記載の電圧発生装置の駆動方法。

【請求項35】 前記第1の電流値から第2の電流値に変化させる操作は、前記データ値に放れる電流の一部の電流値となる付加電圧回路によって規定される第3の電流値を経由して行われることを特徴とする請求項33記載の電圧発生装置の駆動方法。

【請求項36】 前記第3の電流値は、前記第2の電流値と前記付加電圧回路を流れる電流値とに基づいて規定されることを特徴とする請求項35記載の電圧発生装置の駆動方法。

【請求項37】 前記第3の電流値は、前記第1の電流値と前記付加電圧回路を流れる電流値とに基づいて規定されることを特徴とする請求項35記載の電圧発生装置の駆動方法。

【請求項38】 前記第2の電流値は、前記第1の電流値よりも小さいことを特徴とする請求項33乃至37のいずれかに記載の電圧発生装置の駆動方法。

【請求項39】 前記第3の電流値は、前記第1の電流値と前記第2の電流値との間の電流値であることを特徴とする請求項37に記載の電圧発生装置の駆動方法。

【請求項40】 前記第1の電流値から前記第3の電流値への電流値の時間変化率の絶対値は、前記第3の電流値から前記第2の電流値への電流値の時間変化率の絶対値よりも大きいことを特徴とする請求項39記載の電圧発生装置の駆動方法。

【請求項41】 前記第1の電流値と前記第3の電流値との間の電流値は、前記第3の電流値と前記第2の電流値との間の電流値よりも大きいことを特徴とする請求項40記載の電圧発生装置の駆動方法。

【請求項42】 前記第1の電流値と前記第2の電流値とは、前記入力信号に対して前記電圧を生成することを特徴とする請求項33乃至41の付加に記録の電圧発生装置の駆動方法。

【請求項43】 前記第1の電流値と前記第3の電流値との差に基づいて、前記第1の電流値を第2の電流値に変化させる操作を、前記電流値の時間変化率の異なる複数の期間を経て行う必要があるかを判定し、当該判

定で必要であると判定されたときに、前記記録の期間を前記第1の電流値を前記第2の電流値に変化させるようにしていることを特徴とする請求項33乃至42の付加に記録の電圧発生装置の駆動方法。

【請求項44】 前記請求項33乃至43の付加に記録の電圧発生装置の駆動方法により駆動されることを特徴とする電圧発生装置。

【請求項45】 入力信号に対して電圧を生成する電圧発生回路と、電圧発生素子を備えた単位回路と、前記電圧を前記単位回路に供給するデータ値と、を含む電圧発生装置であって、

前記入力信号の変化に伴って前記電圧を増加させる際に、前記データ値の電圧をリセットするリセット回路を備えることを特徴とする電圧発生装置。

【請求項46】 前記電圧に依じた電圧を保持する電圧保持回路を備え、前記リセット回路は、前記データ値及び前記電圧保持手段の電圧をリセットするようにしていることを特徴とする請求項45記載の電圧発生装置。

【請求項47】 前記リセット回路は、前記電圧を増加させる前に前記リセットを行うようにしていることを特徴とする請求項45又は46記載の電圧発生装置。

【請求項48】 入力信号に対して電圧を生成する電圧発生回路と、電圧発生素子を備えた単位回路と、前記電圧を前記単位回路に供給するデータ値と、を含む電圧発生装置であって、

前記入力信号の変化に伴う前記電圧を増加する増加回路を備えることを特徴とする電圧発生装置。

【請求項49】 前記増加回路は、前記データ値の電圧を、所定の電圧に設定するプリチャージ回路であることを特徴とする請求項48記載の電圧発生装置。

【請求項50】 前記増加回路は、前記データ値に放れる電流の一部の電流値となる付加電圧回路であることを特徴とする請求項48記載の電圧発生装置。

【請求項51】 前記入力信号の変化に伴う前記電圧の電流値は、前記増加回路の使用の要否を判断する判断回路を備えていることを特徴とする請求項49乃至50の付加に記録の電圧発生装置。

【請求項52】 請求項29乃至32及び請求項44乃至47の付加に記録の電圧発生装置を、発光部として利用したことを特徴とする電子装置。

【発明の技術分野】

【発明が属する技術分野】 この発明は、発光部品の周知回路などの単位回路の制御に使用されるデータ値の駆動技術に関する。

【0002】

【従来の技術】 近年、有機EL素子(Organic Electroluminescent element)を用いた電圧発生装置が開発されている。有機EL素子は、自発光素子であり、バックライトが不要なので、携帯型電力、視野角、コントラ

スト比の波長範囲を達成できるものと期待されている。  
なお、本発明において、「電圧発生装置」とは、電圧  
信号を光に変換する装置を指している。電圧発生装  
置の最も初期の形態は、回路を流す電圧信号を回路を流す  
光に変換する装置であり、特に光発生装置として好適であ  
る。

[0003] 図1は、有価値1.1を有する電圧発生装置の  
一形態の構成を示すブロック図である。この発生装置  
は、電圧マトリクス120と、ゲートドライバ130  
と、データ線ドライバ140とを有している。電圧マト  
リクス120は、マトリクス状に配列された複数の電  
圧発生素子110を有しており、各電圧発生素子110には有価  
値1.1がそれぞれ付与されている。図2は、電圧マト  
リクス120のマトリクス120は、その列方向に付与する複数の  
データ線X1、X2、…と、行方向に付与する複数の  
ゲート線Y1、Y2、…とがそれぞれ付与されている。  
[0004]

[図2が省略] 図1は、有価値1.1を有する電圧発生装置の構成を示すブロック図である。電圧発生素子110は、マトリクス状に配列された複数の電圧発生素子110を有しており、各電圧発生素子110には有価値1.1がそれぞれ付与されている。図2は、電圧マトリクス120のマトリクス120は、その列方向に付与する複数のデータ線X1、X2、…と、行方向に付与する複数のゲート線Y1、Y2、…とがそれぞれ付与されている。  
[0005] 図1は、有価値1.1を有する電圧発生装置の構成を示すブロック図である。電圧発生素子110は、マトリクス状に配列された複数の電圧発生素子110を有しており、各電圧発生素子110には有価値1.1がそれぞれ付与されている。図2は、電圧マトリクス120のマトリクス120は、その列方向に付与する複数のデータ線X1、X2、…と、行方向に付与する複数のゲート線Y1、Y2、…とがそれぞれ付与されている。

[0006] 本発明は、上述した従来の問題を解決する  
ためになされたものであり、所定電圧に接続されたデー  
タ線の電圧を制御することのできる技術を提供する  
ことを目的とする。  
[0007]

[図3が省略] 図1は、有価値1.1を有する電圧発生装置の構成を示すブロック図である。電圧発生素子110は、マトリクス状に配列された複数の電圧発生素子110を有しており、各電圧発生素子110には有価値1.1がそれぞれ付与されている。図2は、電圧マトリクス120のマトリクス120は、その列方向に付与する複数のデータ線X1、X2、…と、行方向に付与する複数のゲート線Y1、Y2、…とがそれぞれ付与されている。

[0008] 本発明は、上述した従来の問題を解決する  
ためになされたものであり、所定電圧に接続されたデー  
タ線の電圧を制御することのできる技術を提供する  
ことを目的とする。  
[0009] 本発明は、上述した従来の問題を解決する  
ためになされたものであり、所定電圧に接続されたデー  
タ線の電圧を制御することのできる技術を提供する  
ことを目的とする。  
[0010] 本発明は、上述した従来の問題を解決する  
ためになされたものであり、所定電圧に接続されたデー  
タ線の電圧を制御することのできる技術を提供する  
ことを目的とする。

をプリチャージすることが可能なプリチャージ回路を含  
むものとしてもよい。この構成によれば、データ線の電  
圧または電流を容易に促進することができる。  
[0013] なお、前記プリチャージ回路は、前記第2  
の期間以外の期間で前記第1の期間が完了する前  
の特定のプリチャージ期間において前記プリチャージを  
実行するものとしてもよい。この構成によれば、保持キ  
ャパシタへの電流の供給が完了する前にプリチャージが  
行われるので、プリチャージ期間となった保持キャパ  
シタの蓄積電荷量が所望の値からずれることを防止する  
ことができる。

[0014] 前記プリチャージ期間は、前記第1の期間  
が開始される以前に設定されることが好ましい。この構  
成では、プリチャージが保持キャパシタの蓄積電荷量に  
与える影響をより小さく抑えることが可能である。  
[0015] あるいは、前記プリチャージ期間は、前記  
第1の期間の期間の一部を含む期間に設定されるように  
してもよい。この構成によれば、データ線の電流が保  
持キャパシタの蓄積電荷量の増減が原因で変動する場  
合に、保持キャパシタへの電流の供給に要する時間を短縮  
することができる。

[0016] 前記プリチャージ期間は、前記データ線を  
プリチャージすることにより、前記データ線を電圧発生  
回路の中央部以下の低い電圧範囲に相当する電圧とするこ  
とが好ましい。この構成によれば、電圧発生回路が低く、デー  
タ信号によるデータ線の電流または電圧の増減が原因で  
変動する。その時間を短縮することができる。  
[0017] なお、前記プリチャージ回路は、前記デー  
タ線をプリチャージすることにより、前記データ線を電  
圧発生回路の中央部以下の低い電圧範囲に相当する電圧  
とする。この構成によれば、電圧発生回路が低く、デー  
タ信号によるデータ線の電流または電圧の増減が原因で  
変動する。その時間を短縮することができる。

[0018] 各半周期は、複数の電圧レベルにそれぞれ  
分けられている場合に、前記プリチャージ期間は、各色  
成分に対応する電圧で前記データ線を充電または放電す  
ることが可能であることが好ましい。この構成によれば、  
各色成分に共通した電圧にそれぞれデータ線を充電ま  
たは放電するので、データ線の電圧レベルをより短縮す  
ることが可能である。  
[0019] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号の電圧に、前記データ線  
の電圧または電流を制御するための電圧を付加する付  
加電圧回路を含むものとしてもよい。この構成によつて、  
保持キャパシタの蓄積電荷量の増減をより短縮するこ  
とができる。

[0020] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。  
[0021] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。  
[0022] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。

[0021] 前記電圧発生回路は、各データ線に対して  
前記データ信号の電圧を生成する回路に接続されたトランジ  
スタを含むものとしてもよい。この構成によれば、付加電  
流を容易に促進することができる。  
[0022] 本発明による電圧発生装置の第1の電圧発生  
回路は、電圧発生素子と前記電圧発生素子の電圧の増減を制御する  
ための回路とをそれぞれ含む複数の電圧発生回路がマトリクス  
状に配列された電圧発生回路マトリクスと、各電圧発生  
素子の電圧の増減に応じてデータ信号を生成する回路に接続する  
ための複数のデータ線と、を備えたアクティブマトリクス  
型電圧発生回路の電圧発生回路の構成方法であって、少なくと  
も1つの電圧発生回路に前記データ線を介して前記データ信  
号を供給する際に、前記データ線の電圧または電流を増  
加することを特徴とする。

[0023] また、本発明による電圧発生回路は、複数の電  
圧発生回路に介して動作が制御される複数の電圧発生素子と、  
各電圧発生素子に、前記電圧発生素子の動作状態を決定  
するデータ信号を供給するためのデータ線と、前記デー  
タ線に前記データ信号の電圧を出力するためのデータ信号発生  
回路と、前記データ線を介して前記データ信号が供給さ  
れる電圧発生回路に接続される際に、前記データ線の電圧ま  
たは電流を増加するための電圧発生回路と、を備える。  
[0024] 本発明による電圧発生回路は、電圧発生  
回路に介して動作が制御される複数の電圧発生素子と、電圧  
発生素子に、前記電圧発生素子の動作状態を決定するデー  
タ信号を供給するためのデータ線と、前記データ線に前記  
データ信号の電圧を出力するためのデータ信号発生回路と、  
前記データ線を介して前記データ信号が供給される電圧  
発生回路に接続される際に、前記データ線の電圧または電  
流を増加するための電圧発生回路と、を備える。

[0025] この電圧発生回路によれば、入力信号の電  
圧に介して電圧を生成する回路に接続されたデータ線の電  
圧または電流を増加させる回路と、前記データ線の電圧ま  
たは電流を増加させる回路と、を備える。  
[0026] 本発明による電圧発生回路は、電圧発生  
回路に介して動作が制御される複数の電圧発生素子と、電  
圧発生素子に、前記電圧発生素子の動作状態を決定するデー  
タ信号を供給するためのデータ線と、前記データ線に前記  
データ信号の電圧を出力するためのデータ信号発生回路と、  
前記データ線を介して前記データ信号が供給される電圧  
発生回路に接続される際に、前記データ線の電圧または電  
流を増加するための電圧発生回路と、を備える。

[0027] あるいは、前記電圧発生回路は、前記データ線  
に接続される電圧発生回路の一部の電圧発生回路となる付  
加電圧回路とを備えるものとしてもよい。  
[0028] 第2の電圧発生回路は、前記入力信号の電  
圧に介して電圧を生成する回路に接続されたデータ線の電  
圧または電流を増加させる回路と、前記データ線の電圧ま  
たは電流を増加させる回路と、を備える。

[0029] 本発明による電圧発生装置の第2の電圧発生  
回路は、電圧発生素子と前記電圧発生素子の電圧の増減を  
制御するための回路とをそれぞれ含む複数の電圧発生回路  
がマトリクス状に配列された電圧発生回路マトリクスと、  
各電圧発生素子の電圧の増減に応じてデータ信号を生成す  
る回路に接続する回路と、を備えた電圧発生回路の構成方  
法であって、前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。

[0030] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。

[0031] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。

[0032] 前記電圧発生回路は、前記電圧発生素子の電  
圧の増減に応じてデータ信号が生成される期間の期間に  
実行されるものとしてもよい。こうすれば、電圧発生回  
路による電圧発生素子の電圧増減への影響を小さく抑えるこ  
とができる。



1)をレシオに調整して第1と第2のトランジスタ21  
1、212をサブバースに保ったまま、第2のゲート駆り  
V2を11レベルに調整して第3のトランジスタ213を  
オン状態に設定する。第2キャパシタ230には、プロ  
グラミング電圧1mに相当した電圧が予め調整されて  
いるので、第4のトランジスタ214にはプログラミング  
電圧1mとほぼ同じ電圧が加えられる。従って、有価電  
圧が加えられる。この電圧は1mに比べて数倍である。  
このように、第2キャパシタ230の電圧(すなわち電  
圧)が電圧1mによって与えられるタイパの調整回  
路210は、「電圧プロダクト調整」と呼ばれている。  
[0054] 図1は、単一ラインドライバ140の外部  
構成を示す回路図である。単一ラインドライバ140  
あるいは「電圧発生回路」とも呼ぶ。と、付加電圧発生  
30(「付加電圧発生部」とも呼ぶ)とを備えている。  
データ信号発生回路420は付加電圧発生30は、デ  
ータ線Xmと接地電圧との間に並列に接続されている。  
[0055] データ信号発生回路420は、スイッチン  
グトランジスタ41と駆動トランジスタ42との出力接  
続421が、N値分(Nは2以上の整数)並列に接続さ  
れた構造を有している。図1の例ではNは6である。6  
つの駆動トランジスタ42のゲートには、リファレンス  
電圧Vrefが共通に印加されている。また、6つの駆動  
トランジスタ42の利得係数βの比は、1:2:4:  
8:16:32に設定されている。なお、利得係数β  
は、 $\beta = \mu C W / L$  で表わされる。ここで、 $\mu$ はキャリアの移動度、Cはゲ  
ート容量、Wはチャネル幅、Lはチャネル長であ  
る。6つの駆動トランジスタ42は、定電流源として働  
く。トランジスタの電流利得能力は利得係数βに比  
例するので、6つの駆動トランジスタ42の電流利得  
能力の比は、1:2:4:8:16:32である。  
[0056] 6つのスイッチングトランジスタ41の  
ノードは、コンローラ100(図2)から与えられ  
る6ビットのデータ駆動信号Ddataは、「入力部」であ  
る。6ビットによって制御される。データ駆動信号Ddata  
の最下位ビットは、利得係数βが最も小さな(すなわち  
βの利得係数βが最も小さな)出力線421に接続されてお  
り、最上位ビットは利得係数βが最も大きな(すなわちβ  
の利得係数βが最も大きな)出力線426に接続されてお  
り、中間の出力線422は中間の出力線423に接続されてお  
る。この結果、データ信号発生回路420は、データ駆動  
信号Ddataの値に比例した電圧1mを生産する電圧源  
として機能する。データ駆動信号Ddataの値は、有価  
電圧1mより220の電圧の範囲を示す値に調整されてい  
る。従って、データ信号発生回路420からは、有価電  
圧1mより220の電圧の範囲に調整された電圧1mを有する  
データ信号出力される。  
[0057] 付加電圧発生30は、スイッチングトラ

ンジスタ43と駆動トランジスタ44との直列接続で構  
成されている。駆動トランジスタ44のゲート電圧に  
は、リファレンス電圧Vrefが加えられる。スイッチン  
グトランジスタ43のオン/オフは、コンローラ100  
0から与えられる付加電圧発生部150によって制御さ  
れる。スイッチングトランジスタ43がオン状態のとき  
には、リファレンス電圧Vrefに付加電圧発生部150に  
1pが付加電圧発生30からデータ線Xm上に出され  
る。  
[0058] 図2は、付加電圧発生30を利用した場  
合のプログラミング期間Tprにおける電圧  
の変化を示す回路図である。時点11では、データ信号  
発生回路420からプログラミング電圧1mの出力が加  
えられる。また、付加電圧発生30から単一ラインドライバ  
140の出力が加えられる。このとき、単一ラインドライバ  
140から出力される電圧1mは、プログラミング電  
圧1mと付加電圧1pの和(1m+1p)になる。時点  
12で付加電圧1pが停止した後の期間12~14で  
は、プログラミング電圧1mだけが単一ラインドライバ  
410の出力電圧となる。なお、付加電圧1pが加えら  
れる期間11~14の初期の1/4程度の期間に設定  
される。付加電圧1pが加えられる期間11~12をプロ  
グラミング電圧1mが加えられる期間の期間に設定するの  
は、付加電圧1pによる電圧変動への影響を小さくするた  
めである。なお、付加電圧1pの値は、例えばプログラ  
ミング電圧1mの最大値と最小値の中間電圧値の値に設  
定される。  
[0059] 正確に言えば、図2(a)に示す出力電圧  
1mは単一ラインドライバ140の電圧利得能力を示  
しており、データ線Xm上の電圧値1mは、図2  
(b)に示すように電圧が加えられる。すなわち、時点1  
1では、電圧に大きな電圧が加えられるが、徐々に減少し  
て、電圧1(1m+1p)に近づいてゆく。時点12で  
付加電圧発生30がオフになると、電圧1mはさ  
らに減少する。しかし、時点12以降では、電圧自体が  
小さいのでデータ線Xm上の電圧1m(図3)を電圧発生部  
150によって制御される。データ駆動信号Ddata  
の最下位ビットは、利得係数βが最も小さな(すなわち  
βの利得係数βが最も小さな)出力線421に接続されてお  
り、最上位ビットは利得係数βが最も大きな(すなわちβ  
の利得係数βが最も大きな)出力線426に接続されてお  
り、中間の出力線422は中間の出力線423に接続されてお  
る。この結果、データ信号発生回路420は、データ駆動  
信号Ddataの値に比例した電圧1mを生産する電圧源  
として機能する。データ駆動信号Ddataの値は、有価  
電圧1mより220の電圧の範囲を示す値に調整されてい  
る。従って、データ信号発生回路420からは、有価電  
圧1mより220の電圧の範囲に調整された電圧1mを有する  
データ信号出力される。

可能である。なお、この図1の電圧発生部2の電圧値  
への変化は、今回のプログラミング時のプログラミン  
グ電圧1mと付加電圧1pとの和である第3の電圧値(1  
m+1p)を生成して行われる。  
[0061] 図2(b)に示す一点線は、付加電圧1  
pを用いて、単一ラインドライバ140の電圧利得能力  
が一様である場合(図2(c))の電圧値の変化を  
示している。このとき、付加電圧1pを用いる場合  
に比べて期間11~12における電圧が小さいので、  
電圧の変化はより緩やかである。従って、プログラミン  
グ電圧1mに到達しない場合がある。このような場  
合には、図2(c)の電圧値210を正しい電圧にプログラ  
ミング電圧1mに到達しない場合がある。あるいは、正しく  
することができない可能性がある。あるいは、正しく  
プログラミングを行うために、プログラミング期間Tpr  
を延長しておく必要があるという問題を生じる。これ  
に対して、付加電圧1pを用いると、プログラミン  
グ期間Tpr内に正しくプログラミングを行うことが可能  
である。  
[0062] 図3は、プログラミング期間Tprにおけ  
るデータ線Xmの電圧値Qdの変化を示す回路図であ  
る。図3は、図2の動作を電圧値Qdの観点で描いたもので  
ある。図3は、図2における時点11、14は、正確に言  
えば、図3に示されているように、第1のゲート信号V  
1のレベルが変化するときに対応する。  
[0063] 一般に、n番目の行の駆動回路のプログラ  
ミングが開始される前は、データ線Xmの電圧値Qdは  
0(=n-1)番目の行の駆動回路のプログラミン  
グにおけるデータ線Xmの電圧値1mに等しい電圧に  
保持されている。図3は、有価電圧1mの電圧発生部  
と、データ線Xmの電圧値1m(すなわちプログラミン  
グ電圧)と、データ線Xmの電圧値Qdとの関係を示して  
いる。図3は、図2の動作では、電圧1mは最大し、データ  
線Xmの電圧Qd(すなわち電圧Vd)は低下する傾向に  
ある。電圧Qdは、最も低い電圧Vdでは電圧値  
Vdに近い電圧に相当する電圧値となり、最も高い電  
圧Vdでは最も高い電圧に近い電圧に相当する電圧値とな  
る。なお、図3(c)の例では、電圧の値(すなわち  
(n-1)番目の行)のプログラミングにおけるプログラ  
ミング電圧1mが比較的大きく、従って、今回のプ  
ログラミング期間Tprの電圧値Qdが比較的小さい場合  
を想定している。  
[0064] 図3の時点11でプログラミングが開始さ  
れると、データ線Xmは単一ラインドライバ140の利  
得能力1m(=1m+1p)によって電圧1mに電圧  
され、電圧Qdは比較的大きい電圧に電圧が低下  
2で付加電圧1pが加えられると、電圧Qdは電圧発生部  
150の電圧値1mより緩やかになる。しかし、プ  
ログラミング期間Tprの時点13において、所望の

プログラミン  
グ電圧1mに電圧が低下する。図3は、図2の動作では、電圧1mは最大し、データ  
線Xmの電圧Qd(すなわち電圧Vd)は低下する傾向に  
ある。電圧Qdは、最も低い電圧Vdでは電圧値  
Vdに近い電圧に相当する電圧値となり、最も高い電  
圧Vdでは最も高い電圧に近い電圧に相当する電圧値とな  
る。なお、図3(c)の例では、電圧の値(すなわち  
(n-1)番目の行)のプログラミングにおけるプログラ  
ミング電圧1mが比較的大きく、従って、今回のプ  
ログラミング期間Tprの電圧値Qdが比較的小さい場合  
を想定している。  
[0064] 図3の時点11でプログラミングが開始さ  
れると、データ線Xmは単一ラインドライバ140の利  
得能力1m(=1m+1p)によって電圧1mに電圧  
され、電圧Qdは比較的大きい電圧に電圧が低下  
2で付加電圧1pが加えられると、電圧Qdは電圧発生部  
150の電圧値1mより緩やかになる。しかし、プ  
ログラミング期間Tprの時点13において、所望の



ドと、スイッチングトランジスタ610との両方機能を持たせ、スイッチングトランジスタ型P型であり、そのソースがデータ線Xnに接続されている。各スイッチングトランジスタ610のゲートには、コントロール100(図2)からプリチャージ制御信号Preが伝達入力される。プリチャージ電流Vpの電位は、例えば電源電位VDDの型相補電流Vpd(図3)に決定される。プリチャージ電流Vpを定数に調整できるように電位調整を採用してもよい。

(0093) プリチャージ回路600は、プログラミングの完了時に各データ群Xmの充電または放電を行う、プログラミングに要する時間を短縮するための回路である。他記すれば、プリチャージ回路600は、データ群Xmの充電または放電を加速するための放電電加圧部として機能する。また、プリチャージ回路600は、データ群Xmの充電に伴う電圧の変化を加速する加速手段、あるいは、データ群Xmの電圧値を規定の値にリセットするためのリセット部として機能すると考えられることも可能である。

(10004) 同出は、第4実施例におけるプログラムミング期間T<sub>1</sub>の動作をその要理である、この中で、期間113〜115におけるプログラムミングの進行の速に、期間111〜112におけるプリチャージ期間(919P r e c h a r g e)よりも、プリチャージ期間800による充電または放電(プリチャージ)が行われる、このプリチャージによって、データ線X<sub>m</sub>の電位値Q<sub>d</sub>は、プリチャージ電圧V<sub>P</sub>(図14)に於ける所定の値に充電する、換言する、データ線X<sub>m</sub>がプリチャージ電圧V<sub>P</sub>にほぼ等しい電位値で充電する、その後、期間113〜115でプログラムミングが行われると、プログラムミング期間T<sub>1</sub>の時間t<sub>1</sub>において、データ線X<sub>n</sub>の電位値Q<sub>d</sub>が所望のプログラム電位値Q<sub>1</sub>mに於ける電位値Q<sub>1</sub>mに充電する。

(10000) 四上 (4) の一は総数は、ブリチャージの取扱いには、プログラムミングソフトの稼働率や付加機能を利用しない場合の電圧値の変化を示している。この場合も、プログラムミングソフトの稼働率においても、データ間の電圧値が所定のプログラム電圧値 1 mV に対応する電圧値 10 mV に対しては、従って、電圧値 2 10 mV に正しいプログラム電圧値 1 mV を印読して正しい電圧にプログラムミングすることができない可能性が大きい。

【0096】このように、本実施例においては、プログラマが行ってデータ群の光電または放電を加算することにより、照度四等と10に対して正しい発光効率を決定することが可能である。また、プログラマが同定し、有値1、未満220の照度四等例の正位化を図ることができる。

【0097】なお、データ線ドライバ400がデータ線  
50mの絶縁電位側に設けられているときには、前述した

リチャージ電池Vpを直接に充電できるように充電を構成するところが多い。具体的には、R川のデータ線とB用のデータ線とG用のデータ線とに同じでそれぞれ通しただけのリチャージ電池Vpを必要と可能となす。また、リチャージ電池Vpの電圧を上げることも多い。また、同じデータ線に3色分の同様な電圧が供給されている場合、リチャージ電池Vpの電圧を上げることで、出力電圧を差により調整可能で電圧を制御することが好ましい。各色毎にリチャージ電池Vpを個別に調整できるようにすれば、リチャージ電圧をより効果よく行うことができる。

[0103] F. プリチャージタイミングに関する変換例  
例として、プリチャージ期間の変換例を示す図9である。この例では、プリチャージ期間T<sub>Pre</sub>が0.6μsecとある。時間T<sub>Pre</sub>(「プリチャージ期間」)と呼ぶのが第1のターゲット信号1がオンとなる直前の部分であり、正立する場合は期間は短縮されている。この場合には、プリチャージ期間T<sub>Pre</sub>の値平において、保持キャパシタ2(0.33μF)を知り得たは数訂正のための2つのステップで、この保持キャパシタ230データ×数Xmと等しいプリチャージすることが可能である。従って、データ線駆動部が駆動されるに比べて保持キャパシタ230の充電に要する時間が短い場合には、その後のプログラムメモリに書き戻す必要はない場合がある。

(0104) 但し、図14のように、光線のプロトラ  
グを現時する前にプリチャージを行うようにすれば、  
プリチャージが限電キヤパシタ230の蓄電荷量に与  
える影響をより小さく抑えることができる可能性がある。

「010105」なお、図2.11において、プリチャージ期間がpccが終了するまでプログラムミング電流1mAは0に保たれている。この理由は、プリチャージ期間tpccにプログラミング電流1mAを流すと、この電流の増分がプログラミング電流の0.01に相当するので、電流の増分を計算してしまいうからである。但し、これによる電流の増分の増加が無視できる程度の場合には、プリチャージ期間tpcc内にプログラムミング電流1mAを流すようにしてもよ

0103) 図2.11は、プリチャー・ジ期間の値の表形例を示す記号例である。この例では、プリチャー・ジ期間Tが、第1のゲート信号Y1がオンとなった3.0に開始している。この場合にも、保持キャパシタ2.3.0を考慮し、 $X_{m0}$ と同時刻にプリチャー・ジすることから可視である。この例においても、プリチャー・ジ期間Tが終了するまでプログラミング電圧[mを0に保つことが好ま

0107] 以上の説明から理解できるように、ブリヂ  
ンジ知財は、国策国務のプログラムミングが与えられる期  
の前に設定されてもよく(12.11.1)の例、あるいは、

[illegible]

型別 G、プリチャージ面の配置に関する型別  
 型別 H、図 2.2.5 の型別を示す。図 2.2.2 の例では、波  
 長の異なるプリチャージ面 200 nm 以内に複数のプリチャージ面 600 nm  
 が設けられている。この構成は、図 2.1 に示した第 1  
 型別の波長マトリクス部 200 nm プリチャージ面 600 nm  
 を追加した構成である。図 2.2.3 の例では、テーク  
 ライバ 400 nm c 内に複数のプリチャージ面 600 nm が  
 設けられている。図 2.2.4 の例も、波長マトリクス部 200  
 nm 以内に複数のプリチャージ面 600 nm が設けられてい  
 る。但し、図 2.2.4 の構成は、図 2.1 に示した第 2  
 型別の波長マトリクス部 200 nm プリチャージ面 600 nm  
 を追加した構成である。図 2.2.5 の例では、テーク  
 ライドラッド 400 nm c 内に複数のプリチャージ面 600 nm  
 が設けられている。図 2.2.2、図 2.2.3、図 2.2.4、図 2.2.5 の型別の構成は、上  
 述した第 1 型別の構成とほぼ同じである。

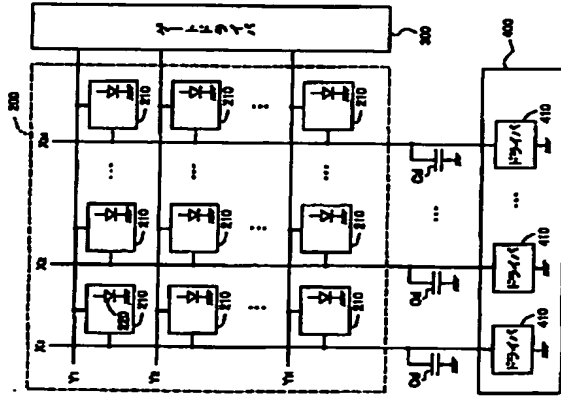
0109) 図22や図23の例のように、プリチャージ600の要求マトリクス部200内に含まれてゐる場合には、プリチャージ600も連続マトリクスとのT/Fで生成される。一方、図23や図25の例のように、プリチャージ400の要求マトリクス部200の外に置かれる場合には、例えば、プリチャージ600の要求マトリクス部200を含む要求パネルにT/Fで作成することが可能であり、あるいは、要求マトリクス部200とは別開のIC内にプリチャージ600を形成することが可能である。

011010101は、ブリチャー・ジラコ600を編入  
他の2枚の編組の例を示している。この方法では、  
1枚目の編組における残量の半一ランドライバ10  
1枚目のブリチャー・ジラコ600のため、1つの半  
ランドライバ10と、1つのブリチャー・ジラコ600と、  
2つのシフトレジスタ700と、が置かれている。  
また、シフトレジスタ800の各データ線には、スイ  
ッチング・トランザクタ250が置かれている。スイ  
ッチング・トランザクタ250の一方の端子は各データ線  
に接続されており、他方の端子は半一ランドライ  
バ10101の出力ライン11に接続されている。

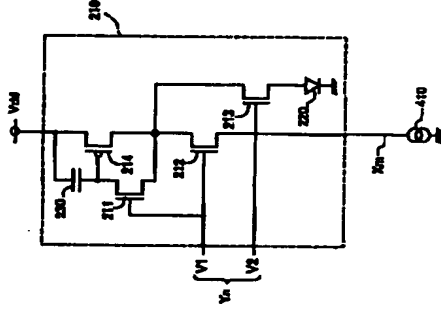




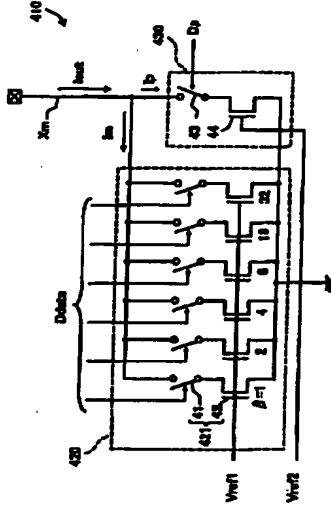
[図3]



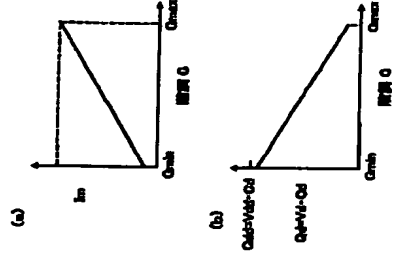
[図4]



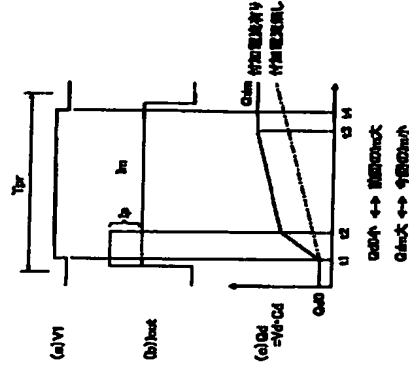
[図5]



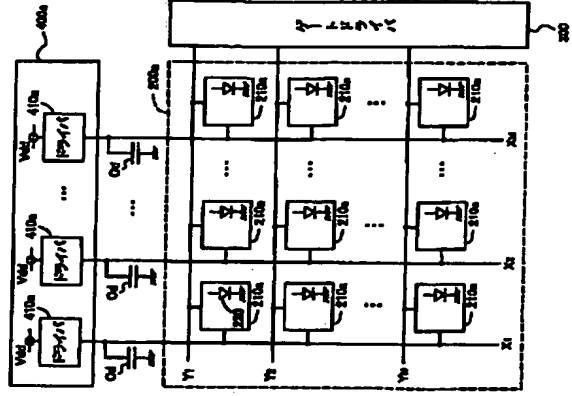
[図6]



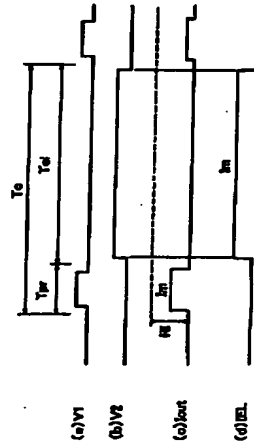
[図8]



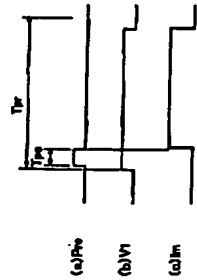
[図10]



[図13]

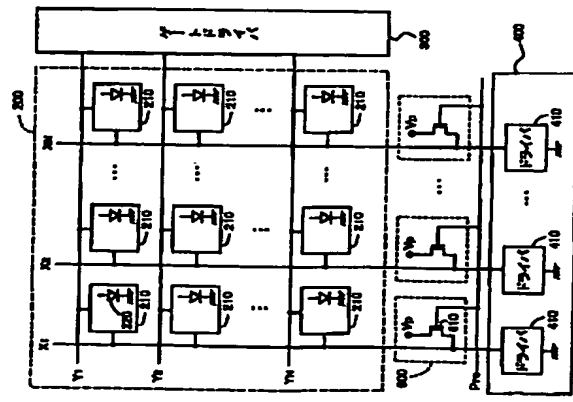


[図21]

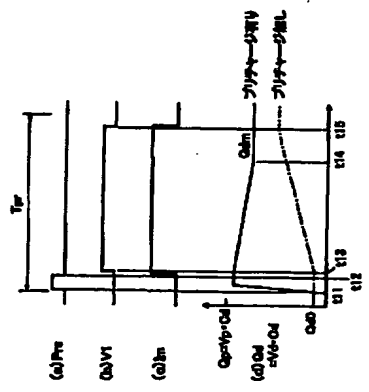




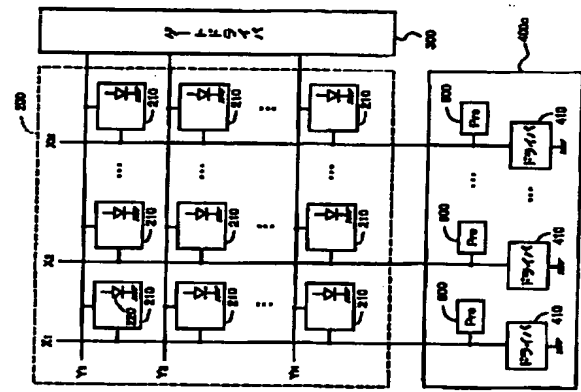
[図1.R]



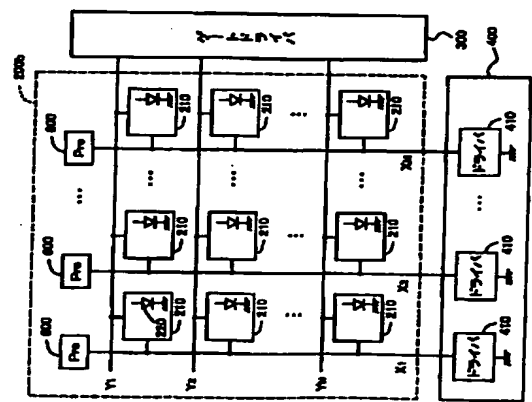
[図1.B]



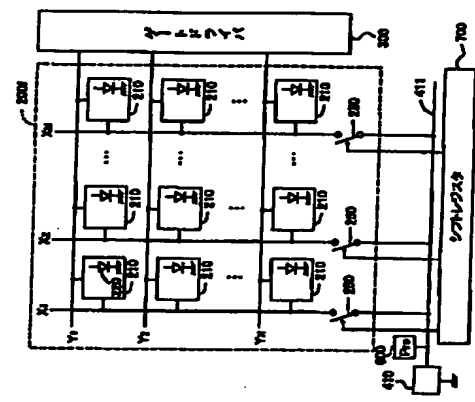
[図2.1]



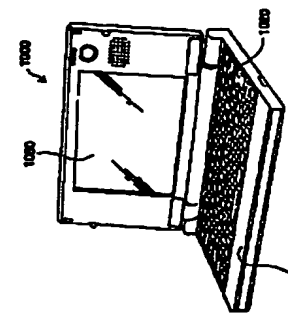
[図2.2]



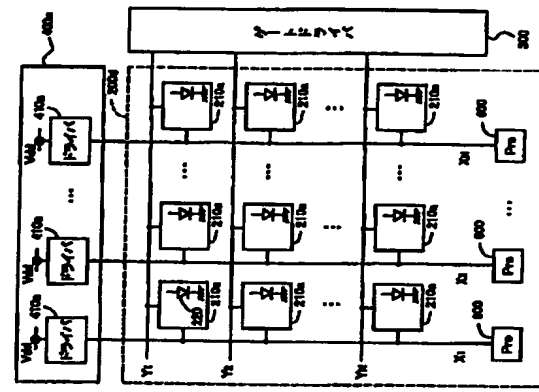
[図2.3]



[図2.7]



[図2.4]



[図2.5]

